



Volume 3

Living Resources

ILLINOIS RIVER BLUFFS AREA ASSESSMENT



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ILLINOIS RIVER BLUFFS AREA ASSESSMENT

VOLUME 3: LIVING RESOURCES

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Other CTAP Publications

The Changing Illinois Environment: Critical Trends, summary and 7-volume technical report
Illinois Land Cover, An Atlas, plus CD-ROM
Inventory of Ecologically Resource-Rich Areas in Illinois
Rock River Area Assessment, 5-volume technical report
The Rock River Country: An Inventory of the Region's Resources
Cache River Area Assessment, 5-volume technical report
The Cache River Basin: An Inventory of the Region's Resources
Mackinaw River Area Assessment, 5-volume technical report
The Mackinaw River Country: An Inventory of the Region's Resources
The Illinois Headwaters: An Inventory of the Region's Resources
Headwaters Area Assessment, 5-volume technical report
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The Kishwaukee River Basin: An Inventory of the Region's Resources
Kishwaukee River Area Assessment, 5-volume technical report
Embaras River Area Assessment, 5-volume technical report
Upper Des Plaines River Area Assessment, 5-volume technical report
Annual Report 1997, Illinois EcoWatch
Stream Monitoring Manual, Illinois RiverWatch
Forest Monitoring Manual, Illinois ForestWatch
Illinois Geographic Information System, CD-ROM of digital geospatial data

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About This Report

The Illinois River Bluffs Area Assessment examines an area in west-central Illinois that includes parts of the upper and lower Illinois River watersheds from the vicinity of Hennepin southward to East Peoria. Because significant natural community and species diversity is found in the area, it has been designated a state Resource Rich Area.¹

This report is part of a series of reports on areas of Illinois where a public-private partnership has been formed. These assessments provide information on the natural and human resources of the areas as a basis for managing and improving their ecosystems. The determination of resource rich areas and development of ecosystem-based information and management programs in Illinois are the result of three processes -- the Critical Trends Assessment Program, the Conservation Congress, and the Water Resources and Land Use Priorities Task Force.

Background

The Critical Trends Assessment Program (CTAP) documents changes in ecological conditions. In 1994, using existing information, the program provided a baseline of ecological conditions.² Three conclusions were drawn from the baseline investigation:

1. the emission and discharge of regulated pollutants over the past 20 years has declined, in some cases dramatically,
2. existing data suggest that the condition of natural ecosystems in Illinois is rapidly declining as a result of fragmentation and continued stress, and
3. data designed to monitor compliance with environmental regulations or the status of individual species are not sufficient to assess ecosystem health statewide.

Based on these findings, CTAP has begun to develop methods to systematically monitor ecological conditions and provide information for ecosystem-based management. Five components make up this effort:

1. identify resource rich areas,
2. conduct regional assessments,
3. publish an atlas and inventory of Illinois landcover,
4. train volunteers to collect ecological indicator data, and
5. develop an educational science curriculum which incorporates data collection

¹ See *Inventory of Resource Rich Areas in Illinois: An Evaluation of Ecological Resources*.

² See *The Changing Illinois Environment: Critical Trends*, summary report and volumes 1-7.

At the same time that CTAP was publishing its baseline findings, the Illinois Conservation Congress and the Water Resources and Land Use Priorities Task Force were presenting their respective findings. These groups agreed with the CTAP conclusion that the state's ecosystems were declining. Better stewardship was needed, and they determined that a voluntary, incentive-based, grassroots approach would be the most appropriate, one that recognized the inter-relatedness of economic development and natural resource protection and enhancement.

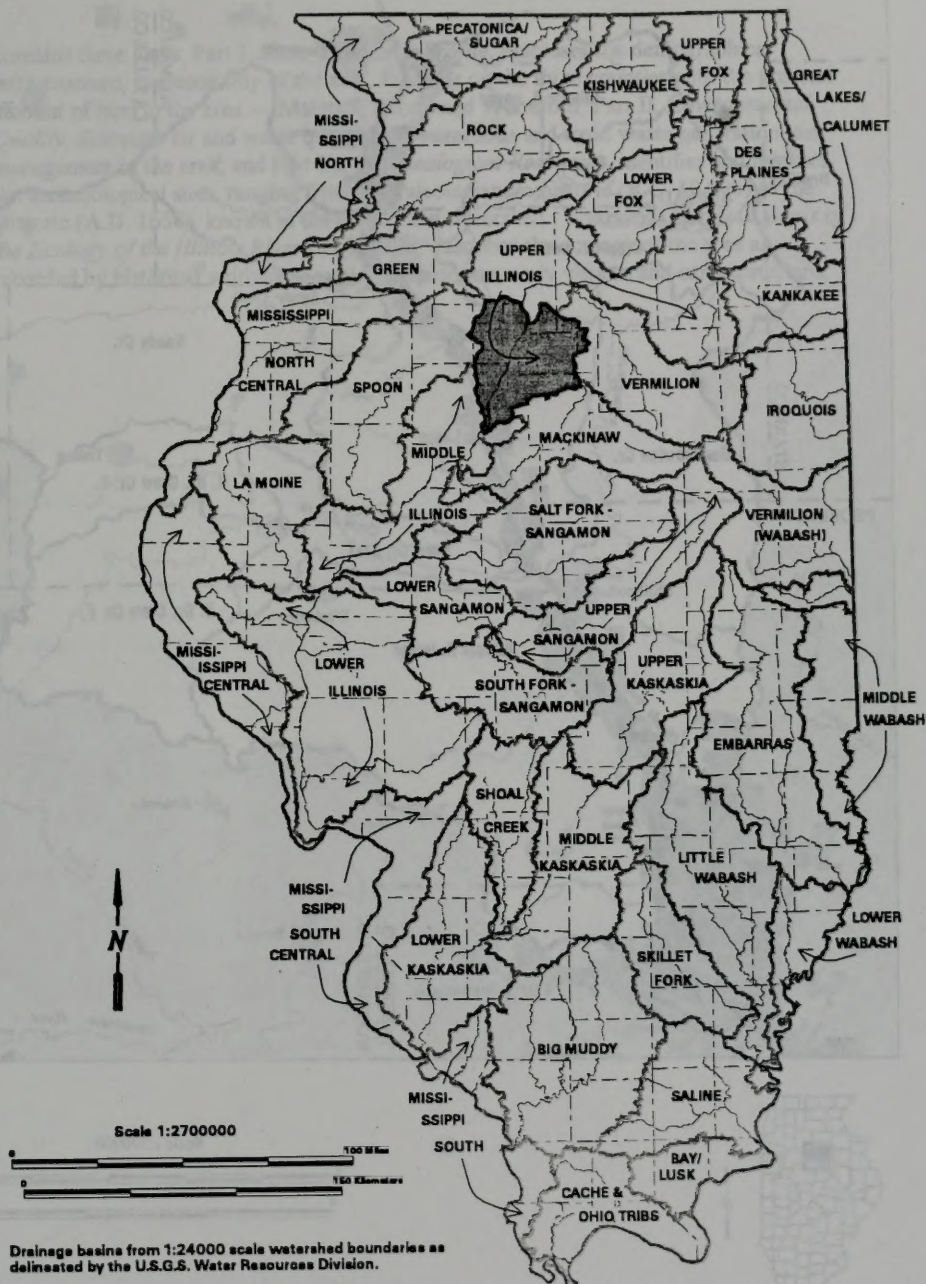
From the three initiatives was born Conservation 2000, a six-year program to begin reversing ecosystem degradation, primarily through the Ecosystems Program, a cooperative process of public-private partnerships that are intended to merge natural resource stewardship with economic and recreational development. To achieve this goal, the program will provide financial incentives and technical assistance to private landowners. The Rock River and Cache River were designated as the first Ecosystem Partnership areas.

At the same time, CTAP identified 30 Resource Rich Areas (RRAs) throughout the state. In RRAs where Ecosystem Partnerships have been formed, CTAP is providing an assessment of the area, drawing from ecological and socio-economic databases to give an overview of the region's resources -- geologic, edaphic, hydrologic, biotic, and socio-economic. Although several of the analyses are somewhat restricted by spatial and/or temporal limitations of the data, they help to identify information gaps and additional opportunities and constraints to establishing long-term monitoring programs in the partnership areas.

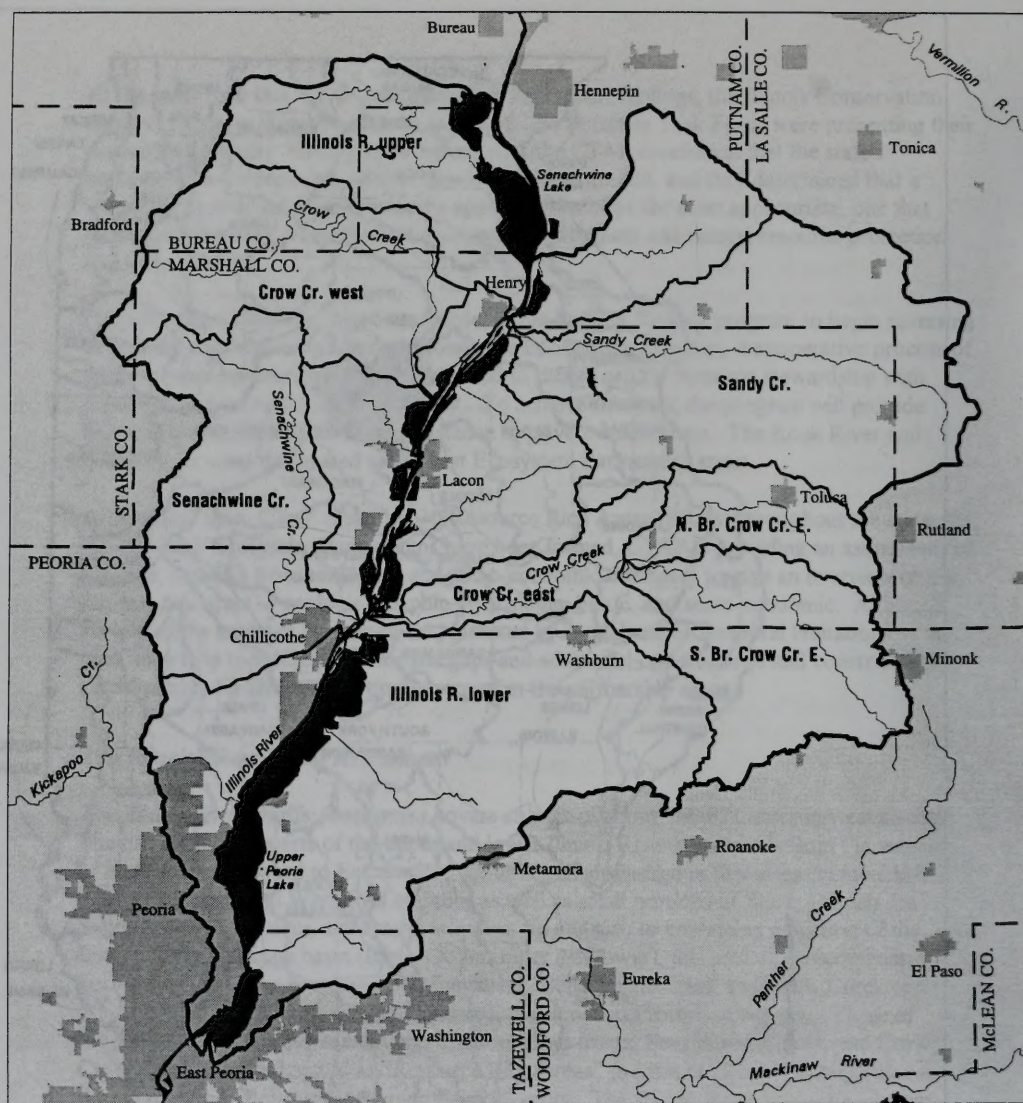
The Illinois River Bluffs Assessment

The Illinois River Bluffs Assessment covers an area of about 560,871 acres in west central Illinois. It includes parts of the upper and lower Illinois River watersheds from the vicinity of Hennepin southward to East Peoria. Counties encompassed in this assessment include most of Marshall and Woodford counties as well as small portions of Stark, Bureau, La Salle, Tazewell, Putnam, and Peoria counties. In addition to containing a portion of the Illinois River Drainage basin (Illinois River upper and lower), this area also encompasses portions of the Crow Creek west, Sandy Creek, Senachwine Creek and Crow Creek east drainage basins as identified by the Illinois Environmental Protection Agency. Three of the sub-basins in this assessment area (Illinois River lower, Senachwine Creek, and Crow Creek east) were designated as "Resource Rich Areas" (a total of 277,847 acres) because they contain significant natural community diversity. The Illinois River Bluffs Ecosystem Partnership was subsequently formed around this core area of high quality ecological resources.

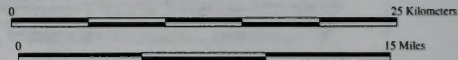
This assessment is comprised of five volumes. In Volume 1, *Geology* discusses the geology, soils, and minerals in the assessment area. Volume 2, *Water Resources*, discusses the surface and groundwater resources and Volume 3, *Living Resources*, describes the natural vegetation communities and the fauna of the region. Volume 4



Major Drainage Basins of Illinois and Location of the Illinois River Bluffs Assessment Area



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Subbasins in the Illinois River Bluffs Assessment Area. Subbasin boundaries depicted are those determined by the Illinois Environmental Protection Agency.

contains three parts: Part I, *Socio-Economic Profile*, discusses the demographics, infrastructure, and economy of the area, focusing on the three counties with the greatest amount of land in the area — Marshall, Peoria and Woodford; Part II, *Environmental Quality*, discusses air and water quality, and hazardous and toxic waste generation and management in the area; and Part III, *Archaeological Resources*, identifies and assesses the archaeological sites, ranging from the Paleoindian Prehistoric (B.C. 10,000) to the Historic (A.D. 1650), known in the assessment watershed. Volume 5, *Early Accounts of the Ecology of the Illinois River Bluffs Area*, describes the ecology of the area as recorded by historical writings of explorers, pioneers, early visitors and early historians.

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Introduction

Physiographic Characteristics

The Illinois River Bluffs Assessment Area (IRBAA) encompasses approximately 876.4 miles² (560,871.2 acres or 226,984.6 hectares) in west central Illinois (Figure 1), including most of Marshall County and parts of Bureau, La Salle, Peoria, Putman, Stark, Tazewell, and Woodford counties. This assessment area includes parts of the upper and lower Illinois River watersheds from the vicinity of Hennepin southward to East Peoria (Figures 1 and 2). The assessment area is wholly within one physiographic division — the Bloomington Ridged Plain Division of the Central Lowland Province (Bier 1980, Leighton et al. 1948). Elevation within the IRBAA ranges from about 950 ft. (290 meters) above sea level at the headwaters of the Senachwine Creek in the northwestern part to about 440 ft. (134 meters) above sea level in the Illinois River floodplain south of Peoria.

The IRBAA extends over three natural divisions (Figure 3, Table 1). The majority of the area – 76.4% (428,305.2 acres or 173,335.1 ha) – lies within the Grand Prairie Section of the Grand Prairie Division (Schwegman 1973). Approximately 19.8% (111,306.2 acres, or 45,045.6 ha) of the IRBAA occurs in the Illinois River Section of the Upper Mississippi River and Illinois River Bottomlands Division, and 3.8% occurs in the Illinois River Section of the Illinois River and Mississippi River Sand Areas Division (21,259.8 acres or 8,603.8 ha).

Table 1. Natural divisions occurring in the Illinois River Bluffs Assessment Area¹.

Division & Section	Acres	% of IRBAA
Grand Prairie/Grand Prairie Section	428,305	76.4
Upper Mississippi River and Illinois River Bottomlands/Illinois Section	111,306	19.8
Illinois River and Mississippi River Sand Areas/Illinois Section	21,260	3.8
Total:	560,871	100.0

¹ Data from the GIS Natural Coverage Database (Illinois Geographic Information System).



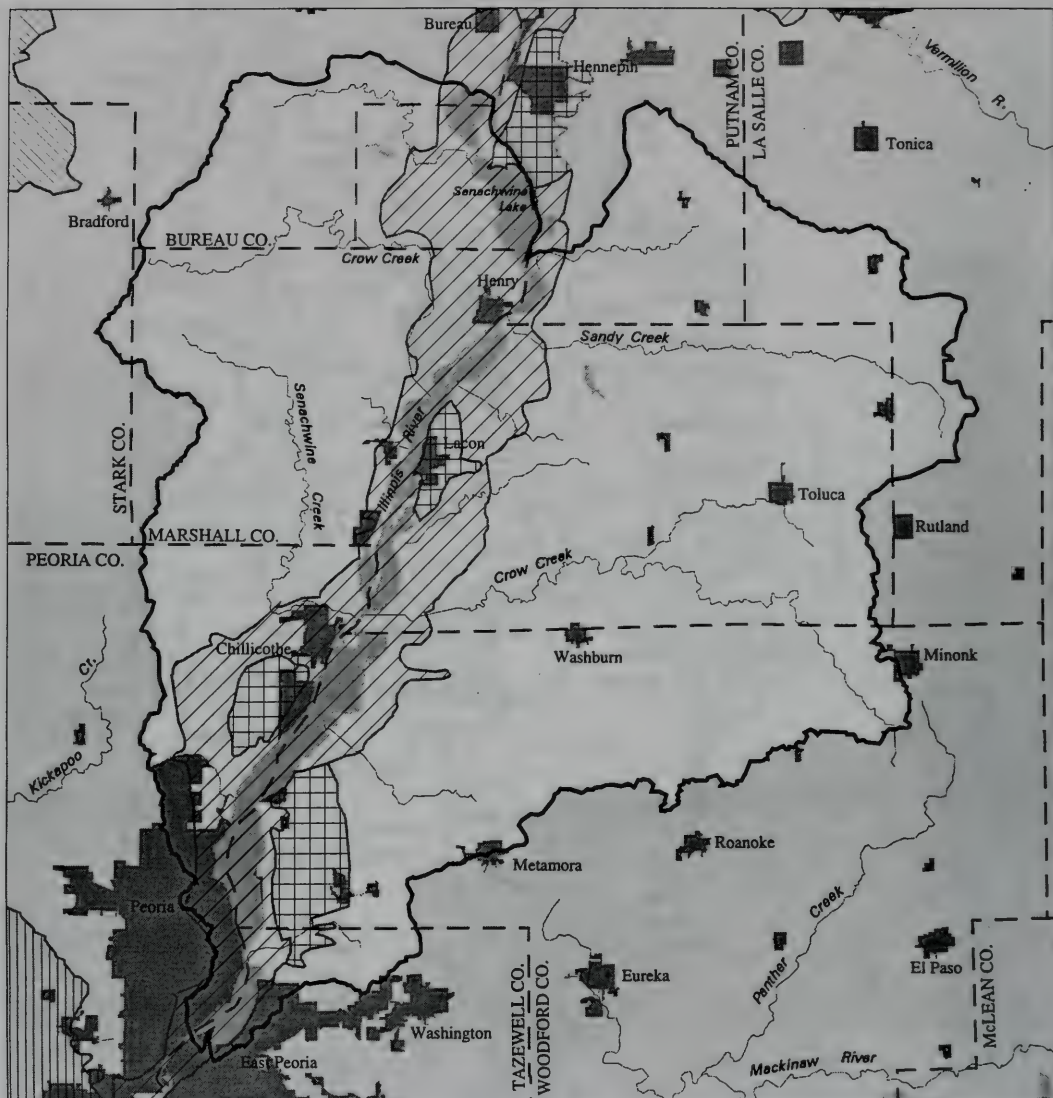
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Figure 1. Subbasins in the Illinois River Bluffs Assessment Area. Subbasin boundaries depicted are those determined by the Illinois Environmental Protection Agency.



Figure 2. Major drainage basins of Illinois and location of the Illinois River Bluffs Assessment Area.



-  Grand Prairie Division
Grand Prairie Section
-  Grand Prairie Division
Western Section
-  Illinois/Mississippi Sand Areas Div
Illinois River Section

-  Upper Miss/Illinois R Bottomlands Div
Illinois R Section
-  Western Forest-Prairie Division
Galesburg Section

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Figure 3. Natural Divisions in the Illinois River Bluffs Assessment Area based on the classification developed by Schwegman (1973).

Occurring to both the east and west of the expanded Illinois River basin, the Grand Prairie Section has gently rolling to flat terrain of Wisconsin drift occupying a large plain defined by the Bloomington moraine systems (Willman and Frye 1970, Barrows 1910; Figure 3). Soils are largely derived from wind-blown loess and drainage is typically poor. Black-soil prairies dominated the area, with many scattered marsh and seep communities (Fehrenbacher et al. 1982). Steep bluffs occur where the Illinois River and creeks have cut through moraines, and the uplands are dissected with an intricate system of small ravines, uneven ridgetops, and steep slopes. Extensive forests occur associated with these ravines adjacent to the Illinois River. The Illinois River [Bottomlands] Section dissects the IRBAA from north to south and an expansive floodplain occurs from the present river channel to the base of moraines on both the east and west sides of the river. Backwater lakes are frequent in this extensive floodplain. The floodplain is mostly forested, although wet and mesic prairies once occurred in the broad bottomlands, and numerous seeps and springs emerge from the moraines. Scattered within and just outside of the Illinois River Section are "islands" that belong to the Illinois River [Sand] Section. These are northern outliers of the much more extensive sand areas prevalent in Mason and Cass counties.

The IRBAA lies within the westernmost edge of the Woodfordian substage (named for Woodford County) of the Wisconsinan glaciation (Figure 4). Based on radiocarbon dating, this period lasted from about 22,000 to 12,500 years before present (Willman et al. 1975). The extensive series of moraines found in the IRBAA are the product of this glaciation. The moraines generally run north to south in the assessment area and are composed of glacial till, mostly clay with some sand and gravel. A layer of very fine wind blown loess was deposited on top of the till as the glaciers were melting, although the loess has eroded away in some areas. This deposit is usually less than 12 feet deep, but locally exceeds 75 feet in depth.

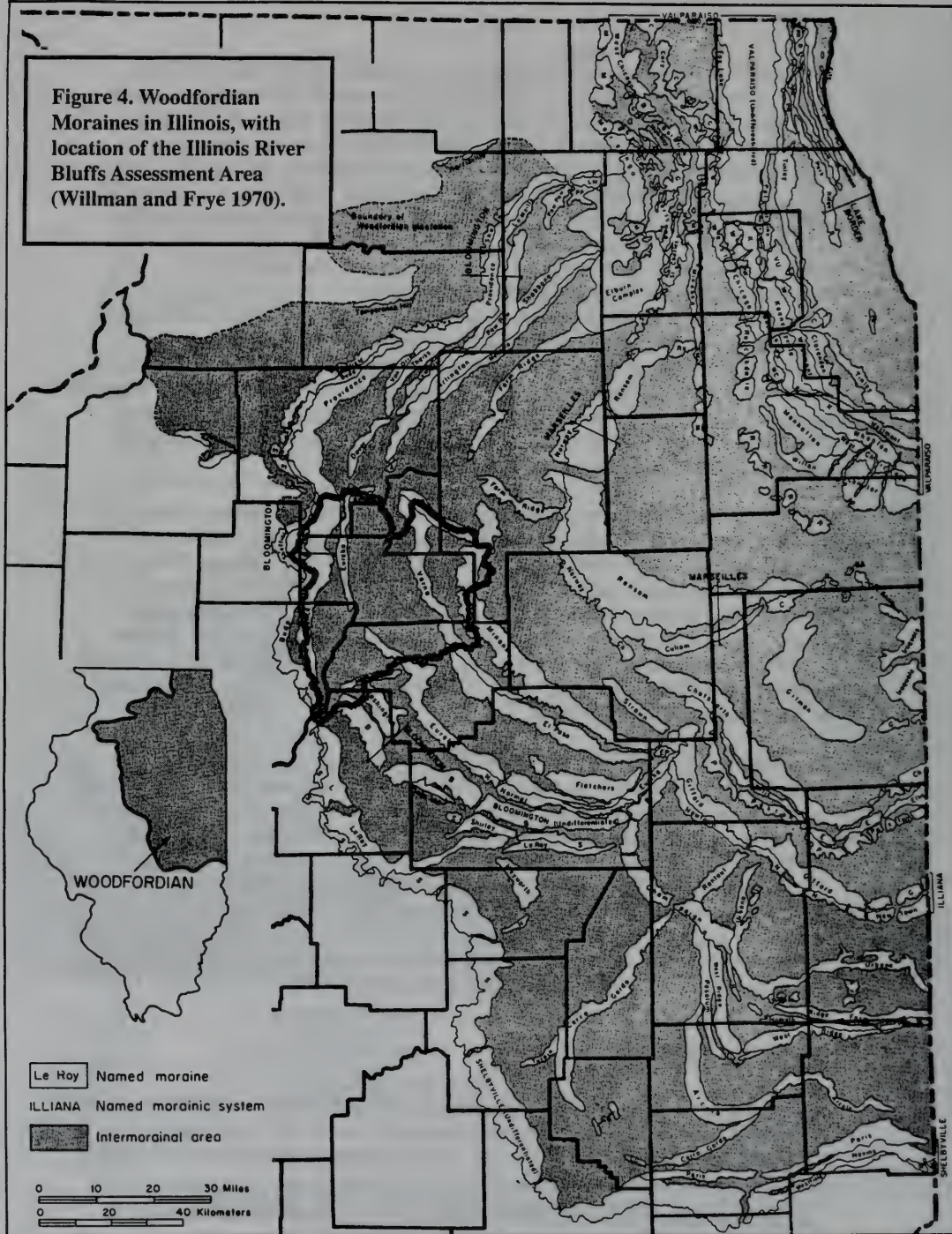
The great size of the Illinois River valley today is due to a huge post glacial flood known as the "Kankakee Torrent." During the melting of the glaciers, large lakes were formed, with the largest being contained by moraines near the present city of Kankakee (Iroquois County). As the glaciers continued to melt, the force of the water eventually cut through these moraines and cascaded down the Illinois River Valley. This event is known as the "Kankakee Torrent" (Willman and Frye 1970) and is the cause of the extremely wide floodplain, especially below present day Hennepin, formed by the floodwaters cutting through the moraines. In addition to the extreme erosion of the Kankakee Torrent, large amounts of gravel and sand were deposited as the water velocity dropped. The resulting landscape seen today is much more rugged than in most other parts of the Grand Prairie Division.

Climate Patterns¹

The climate in the IRBAA is typical of many continental locations, in that there are rather wide temperature fluctuations. The average high temperature (°F) in the summer is in the 80s with average lows in the 50s and 60s. Winter highs are generally in the 20s and 30s

¹ Information in this section has been taken from the Illinois River Bluffs Area Assessment, Volume 2 (Illinois Department of Natural Resources 1998). See that volume for a more detailed discussion of climate patterns and long term trends in the IRBAA.

Figure 4. Woodfordian Moraines in Illinois, with location of the Illinois River Bluffs Assessment Area (Willman and Frye 1970).



with lows in the teens and 20s. Record temperature extremes range from -25° F to a high of 113° F. There is an average of six months without frost each year.

Precipitation is highest during April through September (averages of 3.31 to 3.97 inches per month) and lowest in January (1.71 inches) and February (1.24 inches), with a yearly average of 34.20 inches.

Vegetation History

The presettlement vegetation in Illinois can be described generally as prairie and forest. Interpretations of the original distribution of prairie and forest (Vestal 1931a, b; Anderson 1970, 1991; Iverson et al. 1989) consistently indicate that prairie occupied about 60% and forest about 40% of the State's total land area. Figure 5 shows the presettlement patterns of forest and prairie in the IRBAA. Calculations based on the map by Iverson and Joselyn (1990) indicate that in 1820, prior to European settlement, about 32.2% (180,644 acres, 73,107 hectares) of the IRBAA was covered with forest, while prairie covered 62.3% (349,354 acres, 141,384 hectares); the remaining 5.5% (30,863 acres [12,490 hectares]) was covered by water (Table 2). Sharp contrasts existed regionally and between counties in the distribution of prairie and forest (Table 2). For example, estimates for Peoria County are that forest covered 46.8% and prairie 52.2% while in La Salle County forest covered 15.3% and prairie 84.3%. Forest vegetation mostly was found along the Illinois River and tributaries, with bottomland forests in the floodplain of the river and upland forests on the ravines of the dissected morainal system. Blacksoil prairie was prevalent in the flat to rolling intermorainal areas, sand prairies may have occurred on glacial sand deposits on terraces of the Illinois River, and hill prairies were frequent on steep southwest-facing slopes on both the east and west sides of the Illinois River (Evers 1955).

Table 2. Extent of forest, prairie, and open water habitats in the eight counties that have areas included in the Illinois River Bluffs Assessment Area during the early 1800s, prior to European settlement.

Area	Forest			Prairie			Open Water		
	Acres	Hectares	Percent	Acres	Hectares	Percent	Acres	Hectares	Percent
IRBAA ¹	180,644	73,107	32.2	349,354	141,384	62.3	30,863	12,490	5.5.0
Bureau ²	116,400	47,107	21.0	435,600	176,287	78.7	2,100	850	0.4
La Salle	111,300	45,043	15.3	612,800	248,000	84.3	3,200	1,295	0.4
Marshall	66,500	26,913	26.3	178,200	72,118	70.5	8,200	3,319	3.2
Peoria	187,000	75,679	46.8	208,700	84,461	52.2	4,000	1,619	1.0
Putnam	42,400	17,159	38.6	58,900	23,837	53.6	8,500	3,440	7.8
Stark	42,900	17,362	23.5	140,000	56,658	76.5	0.0	0.0	0.0
Tazewell	129,000	52,206	31.1	281,900	114,085	67.6	5,500	2,226	1.3
Woodford	93,300	37,759	27.1	240,000	97,128	69.9	10,218	4,135	3.0

¹ IRBAA data from Illinois Geographic Information System database based on Iverson and Joslyn 1990.

² County data from Iverson et al. 1989.

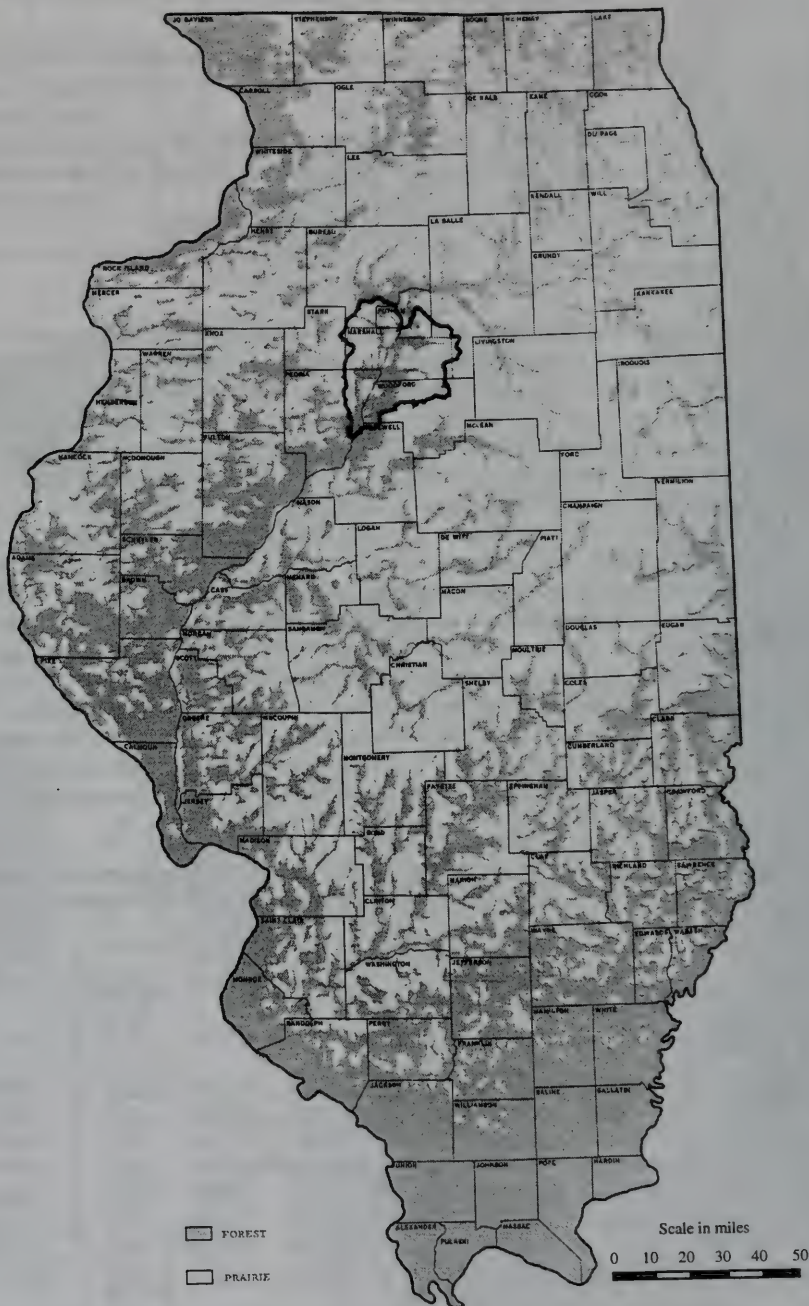


Figure 5. Distribution of forests and prairies in Illinois about 1820 (Anderson 1970) with location of the Illinois River Bluffs Assessment Area.

The above figures are simplistic because the original native vegetation of the IRBAA was a complex mosaic of different types of forests, savannas, blacksoil prairies, sand prairies, hill prairies, and marshes, with locally occurring seeps, fens, sedge meadows, ponds, and lakes. Part of the IRBAA is within the transition zone of prairie and forest (Anderson 1983) and probably supported considerable amounts of tallgrass savanna (Nuzzo 1986), and from the Illinois map in the latter publication, it can be inferred that savanna was a frequent vegetation type. Prairies tend to occur on flat to slightly sloping landscapes (with hill prairies on steep, southwest facing slopes), while forests dominate terrain that has greater topographic relief, such as ravines and stream valleys (with floodplain forest on flat areas along waterways). Savannas typically were spatially dynamic and their total area and distribution varied on the presettlement landscape depending on several factors, including local conditions of climate and fire frequency and intensity (Taft 1997). Fire generally is considered to have been a major ecological factor in the maintenance of tallgrass prairie, savanna, and open woodland vegetation in the Midwest (Abrams 1992; Anderson 1970, 1983, 1990; Axelrod 1985; Collins and Gibson 1990; McClain and Elzinga 1994; Taft et al. 1995). Fire, drought, and grazing animal herds collectively are considered to have had important impacts on community structure and species composition of vegetation within the tallgrass prairie region (Damhoureyeh and Hartnett 1997, Gleason 1913, Robertson et al. 1995, Rodgers and Anderson 1979).

Total area of wetlands prior to European settlement can be inferred from county-wide data on the amount of hydric soils (Havera and Suloway 1994, Havera et al. 1997). A summary of these presettlement estimates of wetlands is presented in Table 3. The percent of the total land area in wetlands varied from 14% in Stark County to 31% in La Salle County, with an average of 19.25%. Estimates of the current extent of natural and artificial wetlands have been prepared by county for Illinois (Suloway and Hubbell 1994, Havera et al. 1997), and show the great reduction in wetland area since presettlement times.

Table 3. Total wetland acreage at the time of European settlement and during the 1980s in the eight counties that have areas included in the Illinois River Bluffs Assessment Area.

County	<u>Presettlement¹</u>			<u>1980-1987²</u>		
	Acres	Hectares	Percent	Acres	Hectares	Percent
Bureau	104,400	42,251	20	12,292	4,975	2.2
La Salle	213,700	86,484	31	9,296	3,762	1.3
Marshall	36,000	14,569	15	7,151	2,894	2.8
Peoria	52,900	21,409	15	17,111	6,925	4.3
Putnam	15,300	6,192	15	5,040	2,040	4.6
Stark	24,700	9,996	14	1,171	474	0.6
Tazewell	90,300	36,544	24	13,804	5,586	3.3
Woodford	68,100	27,560	20	16,199	6,556	4.7

¹ Presettlement figures from Havera et al. 1994.

² 1980s data from Suloway and Hubbell 1994.

Current Land Cover

The characterization of the land cover of the IRBAA is based on information from the Land Cover of Illinois database (Illinois Geographic Information System), which was derived from Landsat Thematic satellite imagery acquired between 1991 and 1995. Figures given for high quality acreages are based on the Illinois Natural Areas Inventory¹ Grade "A" and "B" land. They are meant only to reflect the areas that remain in an undegraded condition and to provide an opportunity to compare statewide trends of habitat destruction.

Currently, the landscape of the IRBAA is dominated by agricultural land use. Based on data from the Illinois Geographic Information System, about 59.7% of the current land cover in the IRBAA is cropland (Figure 6, Table 4). Urban/built up land accounts for 2.6% (14,665 acres) of the area (Table 4). The larger urban/built-up areas are the Peoria area, Chillicothe, and Henry (Figure 7).

Table 4. Current land cover for the Illinois River Bluffs Assessment Area.

Land Cover	Acres	Percent
Cropland	335,091	59.7
Grassland	84,886	15.1
Upland forest	77,378	13.8
Nonforested wetlands	19,368	3.5
Water	15,564	2.8
Urban/Built-up	14,665	2.6
Bottomland forest	13,919	2.5
Total	560,874	100.0

¹ Acreage from the from the Land Cover of Illinois Database (Illinois Geographic Information System).

Grassland occupies 15.1% of the assessment area; this land cover class includes pastures, hay, idle fields, road and railroad rights-of-way, (mostly planted with non-native cool season grasses) and remnant prairies (Table 4, Figure 8). Although there are 84,886 acres of grassland in the IRBAA, only 18.9 acres of high-quality (undegraded) native prairie is left in the area. An unknown quantity of degraded prairie persists locally, some of which may have high restoration potential.

Approximately 16.3% of the area is woodland, with 13.8% being upland forest and 2.5% bottomland forest (Table 4). As in the presettlement landscape, much of the forested area is concentrated on the slopes and bottomlands associated with rivers and their tributaries (Figure 9).

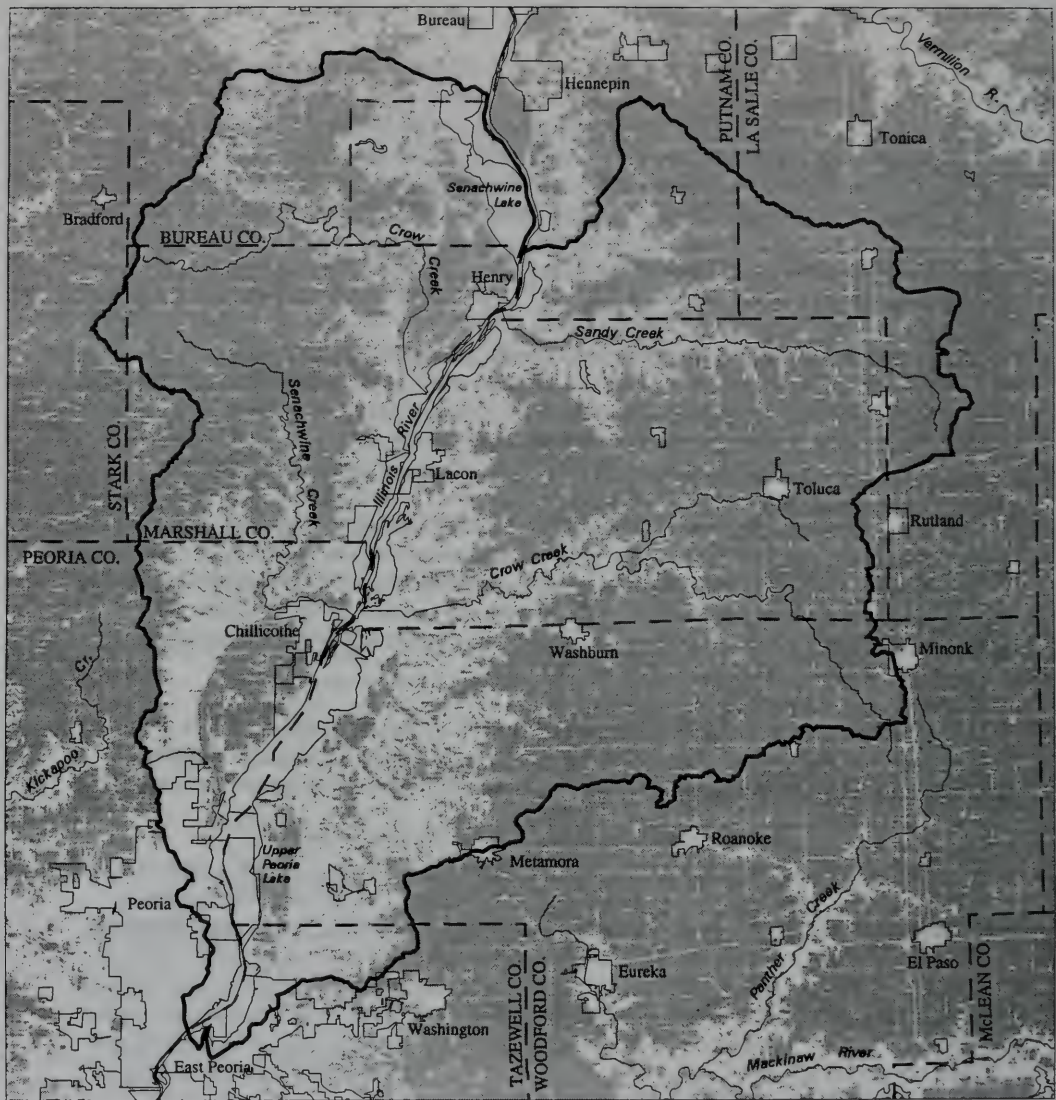
¹ For a complete description of the Illinois Natural Areas Inventory, see the section on "Biologically Significant Features of Natural Communities" later in this chapter.

Wetlands have also declined dramatically in the IRBAA. Based on the Land Cover of Illinois Database (Illinois Geographic Information System), a current estimate of total wetland area in the region (bottomland forest and nonforested wetlands such as marshes, wet meadows, and ponds) is about 32,287 acres or 6.0% of the IRBAA (Table 4, Figure 10). Open water, which occupies 2.8% of the area (Table 4), is largely concentrated in upper half of the assessment area in the Illinois River floodplain (Figure 11).

The Illinois Wetlands Inventory (IWI) provides more detailed information about the wetlands in the area. For the IRBAA, IWI data were derived from high-altitude photography taken between 1983 to 1986. IWI data are the most recent comprehensive wetlands data available for the state. According to the IWI wetlands occupy 5.9% of the IRBAA area compared to 3.5% of the total area of the state (Suloway and Hubbell 1994). In the IRBAA, wetlands occupy about 33,206 acres (Table 5). Upper Peoria Lake and Peoria Lake, the shallow lakes formed by the impoundment of the Illinois River at Peoria, account for 47% of the wetlands in the assessment area. Statewide, shallow lake wetlands account for only 4.1% of the wetland area. Approximately 35% of the wetland area is bottomland forest, much lower than the statewide percentage of 60.5%. Shallow marsh/wet meadow and open water wetlands such as small ponds each account for about five percent of the area, followed by shrub-scrub (4.1%), intermittent riverine (1.9%), deep marsh (1.8%), perennial riverine (0.4%), and swamp (0.2%). Wetlands are concentrated in the lower Illinois River subbasin, where 80% of the total wetlands are located; this area covers 37% of the IRBAA.

The mean size of contiguous forested wetlands is 13.8 acres (range <.1 to 720 acres); there are 836 separate forested wetland tracts in the Illinois River Bluffs Assessment Area. The three tracts are located in the Illinois River floodplain in the upper half of the assessment area.

Emergent wetlands range in size from less than .1 acre to 74 acres, with a mean size of 3.1 acres. There are 722 separate emergent wetlands in the IRBAA. The largest emergent wetland is located in the Marshall County conservation area near Chillicothe.



Scale 1:370000



Figure 6. Cropland in the Illinois River Bluffs Assessment Area. Cropland depicted on this map includes row crops and small grains from the Land Cover of Illinois database, which is based on Landsat Thematic Mapper (TM) satellite imagery from 1991-1995.

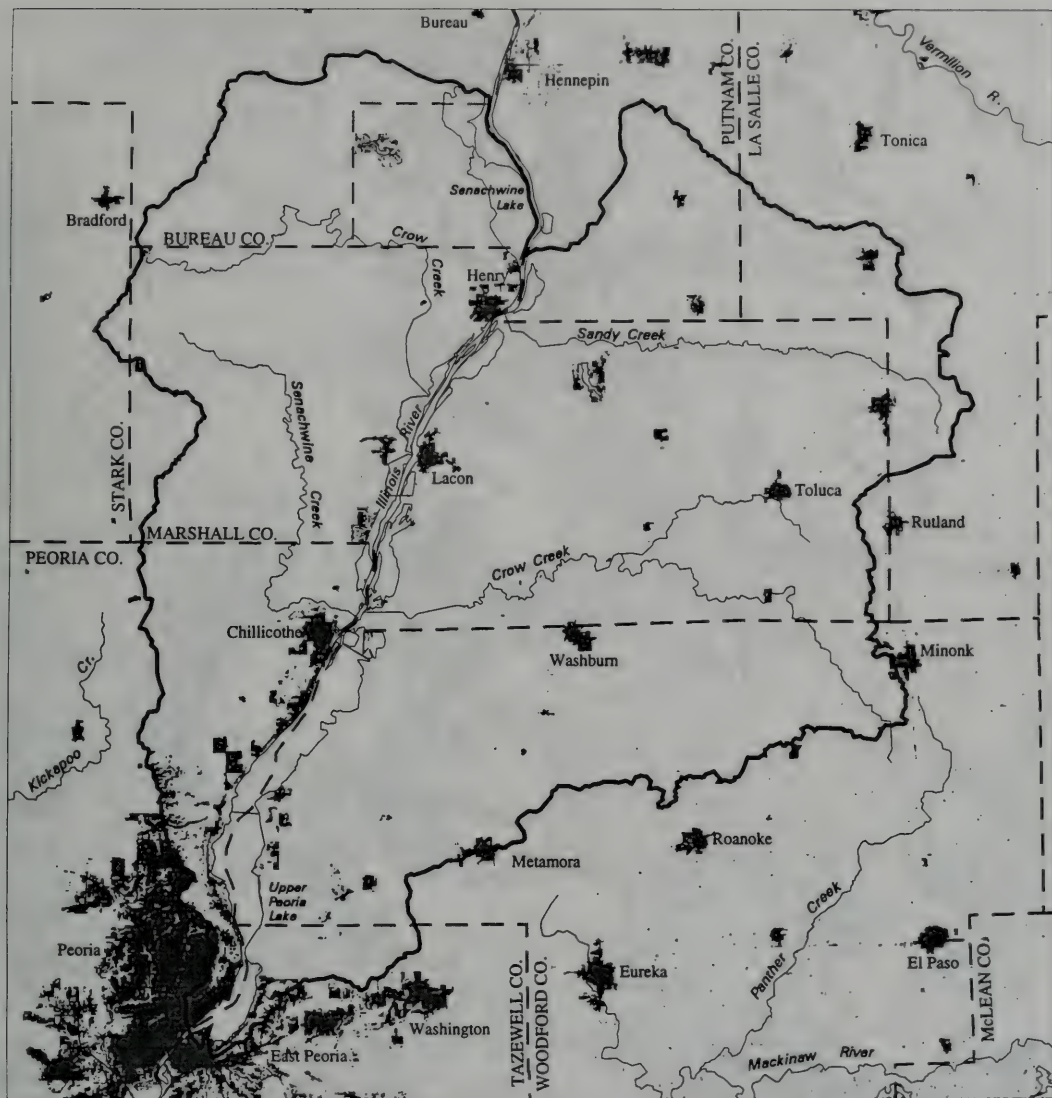


Figure 7. Urban land in the Illinois River Bluffs Assessment Area. Urban land depicted on this map includes urban/built-up land and urban grassland from the Land Cover of Illinois database, which is based on Landsat Thematic Mapper (TM) satellite imagery from 1991-1995.



Scale 1:370000



Figure 8. Grasslands in the Illinois River Bluffs Assessment Area. Grasslands depicted on this map are nonurban grasslands from the Land Cover of Illinois database, which is based on Landsat Thematic Mapper (TM) satellite imagery from 1991-1995.

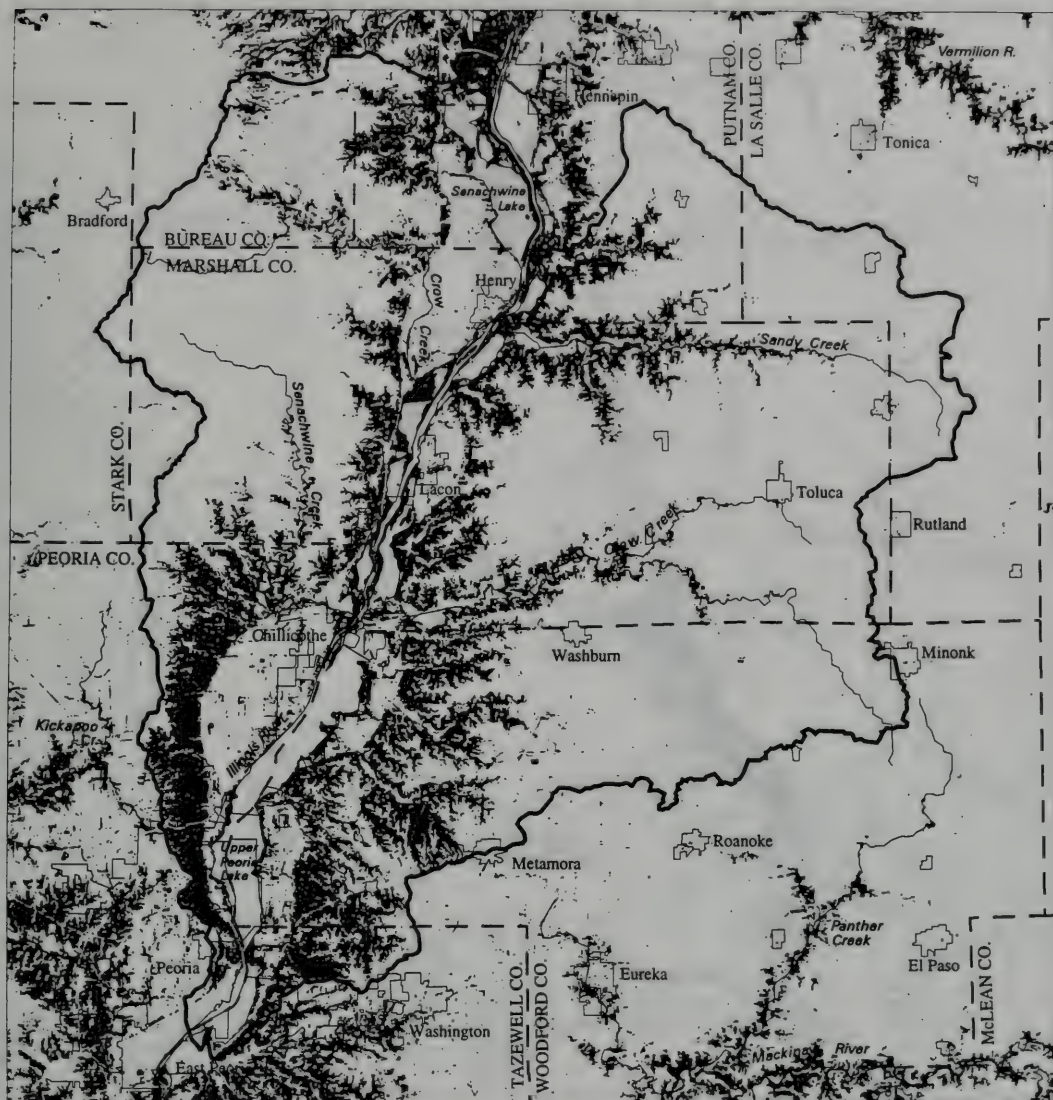
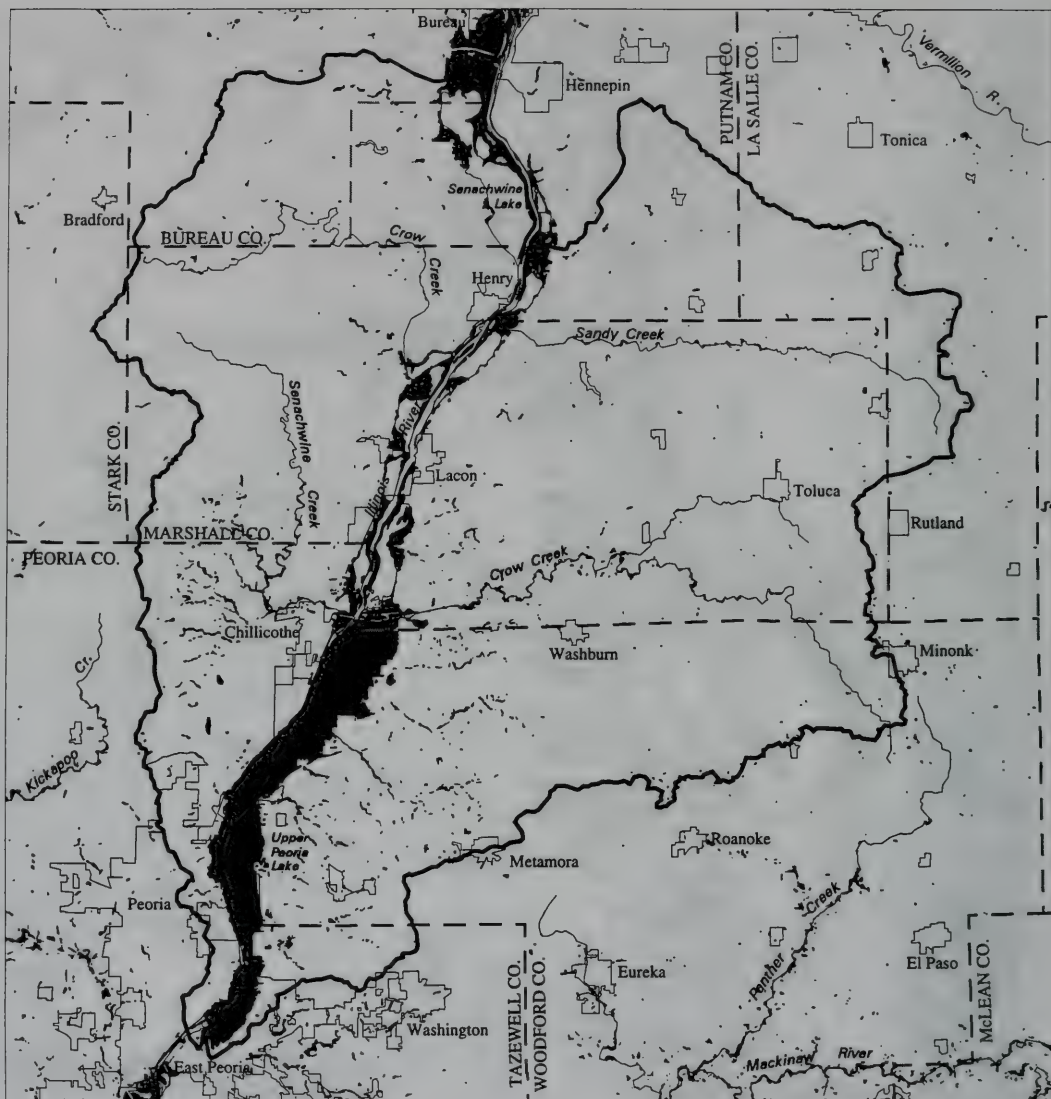


Figure 9. Forest in the Illinois River Bluffs Assessment Area. Forest depicted on this map includes upland and bottomland forest from the Land Cover of Illinois database, which is based on Landsat Thematic Mapper (TM) satellite imagery from 1991-1995.



Scale 1:370000



Figure 10. Wetlands in the Illinois River Bluffs Assessment Area. Wetlands depicted on this map include nonforested wetlands and bottomland forest from the Land Cover of Illinois database, which is based on Landsat Thematic Mapper (TM) satellite imagery from 1991-1995.

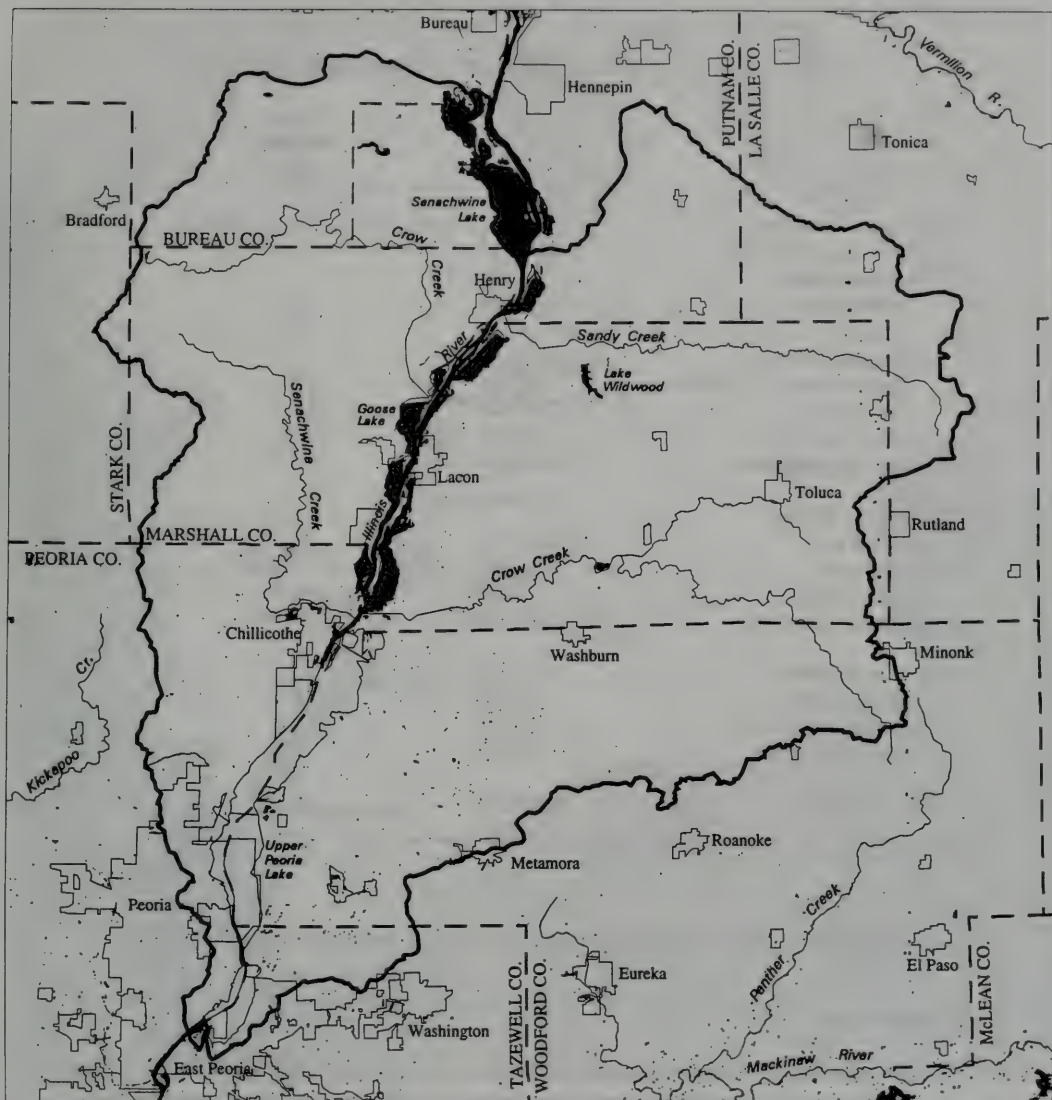


Figure 11. Open water in the Illinois River Bluffs Assessment Area from the Land Cover of Illinois database, which is based on Landsat Thematic Mapper (TM) satellite imagery from 1991-1995.

Table 5. Wetland habitat of the Illinois River Bluffs assessment area¹.

Category	Acreage	% of Wetland Area	% of Assessment Area
Palustrine Wetlands			
Shrub-Scrub Wetlands	1,354.14	4.1	0.2
Forested Wetlands			
Bottomland Forest	11,595.36	34.9	2.1
Swamp	60.03	0.2	0.0
Emergent Wetlands			
Shallow Marsh/Wet Meadow	1,683.35	5.1	0.3
Deep Marsh	593.25	1.8	0.1
Open Water Wetlands	1,640.91	4.9	0.3
Subtotal Palustrine	16,927.04	51.0	3.0
Lacustrine Wetlands			
Shallow Lake	15,527.21	46.8	2.8
Lake Shore	7.09	0.0	0.0
Emergent Lake	0.00	0.0	0.0
Subtotal Lacustrine	15,534.30	46.8	2.8
Riverine Wetlands			
Perennial Riverine	129.96	0.4	0.0
Intermittent Riverine	614.63	1.9	0.1
Subtotal Riverine	744.59	2.2	0.1
Total Wetlands	33,205.93	100.0	5.9



¹Adapted from Suloway and Hubbell (1994).

Biologically Significant Features of Natural Communities

State and Federal Land

Although the majority of the land in the IRBAA is used for agricultural purposes, 11,097 acres (about 2% of the IRBAA) have been set aside by the state or federal government as state parks, forests, and conservation areas (Table 6, Figure 12). These areas give some level of protection to the natural communities in the area, and in some cases they are the only refuge for certain endangered species or natural communities. However, these areas do not always offer adequate protection, and they are not all situated in the most biologically important areas.



 **State Land**
 **Federal Land**

Scale 1:370000



Figure 12. State and federal land in the Illinois River Bluffs Assessment Area. State land is limited to parks (SP), conservation areas (SCA), forests (SF), and fish and wildlife areas (SFWA).

Table 6. State and federal land in the Illinois River Bluffs Assessment Area.

<u>Name:</u>	<u>Acres</u>
State Land:	
Illinois River State Fish and Wildlife Area	1,657
Marshall County State Conservation Area	3,199
Sparland - Marshall County State Conservation Area	1,068
Spring Branch - Marshall County State Conservation Area	773
Woodford County State Conservation Area	2,778
Total State Land:	9,475
Federal Land:	
Cameron-Billsbach Unit	1,622
Total Federal Land:	1,622

Natural Area and Nature Preserves

In 1978, an inventory of natural areas in Illinois was completed by the University of Illinois and the Natural Land Institute under a contract with the Illinois Department of Conservation (now the Illinois Department of Natural Resources). The original inventory was a three-year project that consisted of surveys to find, evaluate, describe, and classify natural areas of statewide significance (White 1978). The Illinois Natural Areas Inventory (INAI) is an ongoing process. The methods and criteria established during the original inventory are still used today to continually update the INAI by re-evaluating the previously defined natural areas or finding new sites that qualify.

The INAI established seven categories of natural areas based on significant features. The categories are: I - High Quality Natural Communities; II - Habitat for Endangered Species; III - Habitat for Relict Species; IV - Outstanding Geological Areas; V - Approved Natural Areas and Restoration Sites; VI - Unique Natural Areas; and VII - Outstanding Aquatic Areas. The INAI established a grading system to designate natural quality (White 1978). The natural quality of a community or area was graded from "A" (relatively stable or undisturbed) to "E" (very early successional or severely disturbed). In general only A and B communities are designated as significant or exceptional features.

Within the IRBAA, 29 sites qualify as natural areas for the INAI (Table 7, Figure 13), totaling 2,459.12 acres (995.21 hectares). While this amount represents only 0.4% of the total area of the Assessment Area, it is quite a high figure for central Illinois. A number of natural communities are included with these natural areas: upland forest; bottomland forest; blacksoil, gravel, and sand prairie; savanna; marsh; tall shrub fen; and seeps. In addition, lower quality natural communities of these and other types can be found, or used to occur, in some of these natural areas.

Table 7. Natural areas in the Illinois River Bluffs Assessment Area¹.

NA# ²	County	Acres	Name
79	La Salle	158.2	Matthiessen
81	La Salle	257.5	Margery C. Carlson
96	Putnam	86.8	George S. Park Memorial Woods
133	Tazewell	6.3	Fort Creve Coeur Hill Prairie
134	Woodford	9.7	Caterpillar Hill Prairies
137	Stark	50.7	Harper's Woods
142	Peoria	13.4	Dickison Run Hill Prairie
143	Peoria	4.5	Mossville Road Hill Prairie
188	Putnam	175.9	Wier Hill Prairies
189	Marshall	48.5	Marshall County Conservation Area Hill Prairies
204	Peoria	134.7	Rocky Glen
205	Peoria	64.8	Grandview Woods
206	Peoria	2.5	St. Mary's Cemetery
207	Peoria	482.9	Forest Park
208	Peoria	347.4	Detweiller Woods
209	Peoria	56.9	Boyd's Hollow Woods
210	Peoria	4.4	Springdale Cemetery
212	Peoria	36.8	Wokanda Camp
213	Peoria	71.8	County Line Hill Prairie
231	Marshall	82.3	Hopewell Estates Hill Prairie
233	Peoria	155.0	Robinson Park Hill Prairie
305	Marshall	41.5	Crow Creek Marsh
382	Putnam	344.3	Miller-Anderson Woods
474	La Salle	3.2	Deer Park South Geological Area
788	McLean	52.6 ³	Mackinaw River System
824	Putnam	65.6	Magnolia Hill Prairies
825	Putnam	96.3	Senachwine Seep
851	Tazewell	15.5	Fondulac Seep
852	Tazewell	1.8	Farm Creek Geological Area
928	Woodford	52.5	Spring Bay Fen
929	Woodford	5.3	Partridge Creek Marsh
1127	Marshall	40.9	Leigh Woods
1128	Marshall	16.8	Sparland Unit
1131	Peoria	21.1	Hancher Woods
1133	Putnam	196.2	Clear Creek Eagle Roost
1134	Marshall	2.4	Brown Run-Billsbach Lake
1139	Tazewell	5.2	Cooper Park North
1143	Woodford	9.6	Blalock Creek Site
1419	Peoria	4.7	Rock Island Trail Prairie
1447	Livingston	405.4	Vermilion River
1494	Peoria	1.4	Root Cemetery

¹ Bold type indicates natural areas and their acreage within the IRBAA.² The number of the natural area (NA#) refers to the number designated in the Natural Heritage Database (Illinois Department of Natural Resources 1997b).³ Total area of 788 = 1,690.1 acres. Only 52.6 acres are on the mapped area.

A total of 500.9 acres (202.7 hectares) of high quality, Category 1 natural communities (White 1978, Illinois Department of Natural Resources 1997b) remain in the IRBAA (Table 8). This includes 401 acres (162 hectares) of upland forest. Of the 33,205.93 acres (13,438.4 hectares) of wetlands currently in the Assessment Area, only about 77 acres (31.1 hectares) or 0.2% are high quality and undegraded. Included in this figure for wetlands are 5 acres (2 hectares) of tall shrub fen (100% of the Illinois total for this habitat) and 44 acres (17.8 hectares) of high quality seeps. While prairie comprised 62.3% of the land area prior to European settlement, the only examples of high quality prairies remaining in the IRBAA are 18.9 acres (7.6 hectares) of high quality glacial drift hill prairies (55.6% of the statewide total for this habitat). Only 4 acres (1.6 hectares) of high quality savanna still occur in the Assessment Area. Thus while only 0.08% of the entire Assessment Area contains high quality natural communities, the area does harbor significant amounts of several communities. High quality natural communities are described in more detail in subsequent sections of this report.

Table 8. Category I natural communities represented in the Illinois River Bluffs Assessment Area (IRBAA).¹

Community Type	Grades in IRBAA	Acres of Category I in the IRBAA			Acres of Category I in Illinois			% of Illinois Category I in the IRBAA		
		Grade A	Grade B	Total in IRBAA	Grade A	Grade B	Total in Illinois	Grade A	Grade B	% of Illinois
Dry-mesic upland forest	B	0.0	144.0	144.0	986.0	2084.0	3070.0	0.0	6.9	4.7
Mesic upland forest	A,B	21.0	236.0	257.0	1058.0	1473.0	2531.0	1.0	16.0	10.2
Glacial drift hill prairie	A,B	7.5	11.4	18.9	14.0	20.0	34.0	53.6	57.0	55.6
Mesic savanna	0,0	0.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0
Dry-mesic Savanna	B	0.0	4.0	4.0	0.3	8.9	9.2	0.0	44.9	43.5
Marsh	A,B	0.0	28.0	28.0	310.0	1920.0	2230.0	0.0	1.5	1.3
Tall shrub fen	A	5.0	0.0	5.0	5.0	0.0	5.0	100.0	0.0	100.0
Seep	B	0.0	44.0	44.0	31.0	63.0	94.0	0.0	69.8	46.8
Total		33.5	467.4	500.9	2404.3	5570.9	7975.2			

¹ Category I indicates natural communities that have remained relatively undisturbed and in high quality condition, either Grade A and B (White and Madany 1978).

Nature preserves are areas of land or water in public or private ownership that are formally dedicated to receive maximum protection of significant natural features. The central goal of the nature preserve system, currently with about 250 preserves in the state, is to protect and preserve examples of all significant natural features found in Illinois for the purposes of scientific research, education, conserving biodiversity, and esthetic enjoyment. Nature preserves are administered largely by the Illinois Nature Preserves Commission (INPC). Preserves usually are the shared responsibility of the INPC, the Illinois Department of Natural Resources, and land owners (McFall and Karnes 1995).

A total of 11 Illinois Nature Preserves occur within the IRBAA (Table 9, Figure 13), totaling 1,300.1 acres (526.2 hectares). Compared with many other assessment areas that may contain as little as 236 acres set aside as nature preserves, this figure is quite high. Many nature preserves are small, representing mere fragments of once large natural communities; however, these are still important for conservation (Schwartz and van Mantgem 1997). Since Peoria is one of the largest cities in downstate Illinois, the IRBAA faces many problems in the urban/rural interface; Shafer (1997) discusses the design of nature reserves in this context.

Table 9. Nature preserves in the Illinois River Bluffs Assessment Area and surrounding region.¹

NP# ²	Corr-NA ³	County	Acres	Name
13	207	Peoria	375.1	Forest Park
17	96	Putnam	83.1	Park Memorial Woods Nature Preserve
23	382	Bureau	247.0	Miller-Anderson Woods Nature Preserve
60	81	La Salle	114.0	Margery C. Carlson
76	928	Woodford	30.7	Spring Bay Fen
85	133	Tazewell	23.6	Crevecoeur
100	137	Stark	39.2	Harper's Woods
109	188	Marshall	7.2	Wier Hill Prairie
169	207	Peoria	128.6	Forest Park South
170	234	Peoria	135.2	Robinson Park Hill Prairies
190	851	Tazewell	2.5	Bennett's Terraqueous Gardens
202	79	La Salle	86.5	Matthiessen Dells
210	0	Putnam	1.0⁴	Mount Palatine Cemetery Prairie
226	1419	Peoria	5.0	Rock Island Trail Prairie
230	208	Peoria	286.6	Detweiller Woods
238	1494	Peoria	1.4	Root Cemetery Savanna

¹ Bold type designates nature preserves within the IRBAA.

² The nature preserve number (NP#) refers to the number designated in the Natural Heritage database (Illinois Department of Natural Resources 1997b) and in Figure 13.

³ Each of the nature preserves is associated with a corresponding natural area (Corr.-NA) referred to in Table 7.

⁴ Total area of nature preserve # 210 = 2.8 acres; only 1.0 acre is in the assessment area.

Threatened and Endangered Species

At least 29 species of threatened and endangered plants and animals occur in the IRBAA (Table 10). This number includes 1 species that is federally threatened and 2 species that are federally endangered. Only 2.8% of the state's 363 threatened or endangered plants are known to occur in the IRBAA. For other taxa, the percentage of the state's threatened or endangered species that occur in the area are as follows: mussels (2.8%), fishes (6.7%), amphibians (0.0%), reptiles (0.0%), birds (23.8%), and mammals (33.3%).

This list includes only those species that are known to breed in the IRBAA. Migrant bird species and those that only overwinter in the area are not listed in Table 10; these species will be mentioned in the chapter that describes bird communities.

Table 10. Threatened and endangered species occurring in the Illinois River Bluffs Assessment Area.

(ST = state threatened; SE = state endangered; FT = federally threatened; FE = federally endangered)

Plants:

black-seeded rice grass	<i>Oryzopsis racemosa</i>	ST
decurent false aster	<i>Boltonia decurrens</i>	ST, FT
Hill's thistle	<i>Cirsium hilli</i>	ST
large-seeded Mercury	<i>Acalypha deamii</i>	ST
prairie dandelion	<i>Microseris cuspidata</i>	SE
queen-of-the-prairie	<i>Filipendula rubra</i>	ST
Schreber's aster	<i>Aster schreberi</i>	ST
showy lady's slipper	<i>Cypripedium reginae</i>	SE
soft-leaved arrowwood	<i>Viburnum molle</i>	SE
yellow monkey flower	<i>Mimulus glabratus</i>	SE

Mussels:

spike	<i>Elliptio dilatata</i>	ST
butterfly	<i>Ellipsaria lineolata</i>	ST
ebonyshell	<i>Ellipsaria lineolata</i>	ST
Higgin's eye	<i>Lampsilis higginsii</i>	SE, FE

Fish:

weed shiner	<i>Notropis texanus</i>	SE
cisco	<i>Coregonus artedii</i>	ST

Birds:

Pied-billed Grebe	<i>Podilymbus podiceps</i>	ST
American Bittern	<i>Botaurus lentiginosus</i>	SE
Least Bittern	<i>Ixobrychus exilis</i>	SE
Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>	SE
Northern Harrier	<i>Circus cyaneus</i>	SE
Red-shouldered Hawk	<i>Buteo lineatus</i>	SE
Brown Creeper	<i>Certhia americana</i>	ST
Veery	<i>Catharus fuscescens</i>	ST
Loggerhead Shrike	<i>Lanius ludovicianus</i>	ST
Henslow's Sparrow	<i>Ammodramus henslowii</i>	SE

Mammals:

Indiana bat	<i>Myotis sodalis</i>	SE, FE
river otter	<i>Lontra canadensis</i>	SE
bobcat	<i>Felis rufus</i>	ST

Natural Vegetation Communities

The description of the vegetation for the Illinois River Bluffs Assessment Area (IRBAA) is organized into six sections: 1) Comparison of Biodiversity to Statewide Trends, 2) Threatened and Endangered Species, 3) Disturbance, Habitat Quality, and Restoration Potential, 4) Natural Areas and Nature Preserves, 5) Natural Community Descriptions, and 6) Summary and Recommendations.

Comparison of Biodiversity in the IRBAA to Statewide Trends

In general, it is difficult to provide precise estimates for some trend data in the IRBAA at the community level because the region was characterized by a complex matrix of heterogeneous habitat types. Totals for the amounts of certain community types, for example prairie and savanna, are based partly on arbitrary distinctions. Nevertheless, habitat losses and degradation in the IRBAA appear to be marginally less than statewide trends. In the entire IRBAA there are about 501 acres (203 hectares) of natural habitat remaining in an undegraded condition (0.09% of total area), compared to 0.07% of the total area remaining in a high-quality, undegraded condition throughout the whole state (White 1978). While this figure is low, the area does harbor several noteworthy communities which are described in this chapter. Trends for each community class are discussed below.

Prairie - It is estimated that prairie originally occupied about 21,639,050 acres (58.95%) of the land cover of Illinois, (Iverson et al. 1989). By 1978, only about 2,300 acres of high-quality (Grades A and B) prairie was left in the state, less than 0.01% of the presettlement total (White 1978, Robertson and Schwartz 1994). On a state-wide basis, Iverson (1988) and Iverson et al. (1989) estimate that between 1920 and 1989 about 19,186,210 acres of prairie were converted to agriculture, 1,125,190 acres of prairie were converted to urban areas, and 959,880 acres of prairie were replaced by forest.

Prairie comprised about 62.3% of the land area of the IRBAA, some 349,354 acres (141,384 hectares), prior to European settlement. According to the Illinois Natural Heritage Database, about 18.9 acres (7.6 ha) of high quality prairie have been identified by the Illinois Natural Areas Inventory (INAI) in the IRBAA. All of the 18.9 acres are glacial drift hill prairies, about 55.6% of this rare natural community remaining in the state that is still considered in good condition. The 18.9 acres represents only 0.005% of the prairie found in the IRBAA in 1820. This negligible percentage is much lower than the figure of 0.01% for prairie remaining statewide. More than 100 years ago, Brendel (1887) lamented that the "The largest prairie of the district in question does not exist any more. It was where now the city of Peoria is built, and the little that is left is no more a prairie, for most of the prairie plants are replaced by immigrated foreign weeds." Like nearly all of Illinois, prairies in the IRBAA have essentially been eliminated with only a few small remnants left to remind us of what prairies really were like.

Forest - Iverson et al. (1989) estimated that in 1820 about 13,828,840 acres, or 37.7%, of Illinois was covered with forest. By the mid-1980s, Iverson et al. (1989), and Iverson and Schwartz (1994) estimated that 4.26 million total acres of forest, including second-growth forests and tree plantations, (about 31% of original extent) was present. In the 1970s, the INAI (White 1978) found that only about 11,600 acres of high-quality forest remained in Illinois. This totals only 0.08% of presettlement extent and 0.27% of the remaining forest.

Within the IRBAA, forest and savanna comprised about 32% of the land cover (180,644 acres) in 1820, with unknown proportions of each (Table 2). Currently, about 91,297 acres (36,948 hectares) of forest remain, or about 16.3% of total area (Table 4). This includes 401 acres (162 hectares) of high quality upland forest (Table 8), which is about 0.5% of all existing high-quality upland forest in Illinois. It is noteworthy that 10.2% of the high quality mesic upland forest in Illinois occurs in the IRBAA. Compared with the whole state, where 31% of the area remains forested, there is a greater percentage of remaining forest in the IRBAA (50.5%). About 0.2% of the remaining forest in the IRBAA is considered of high quality, compared to 0.08% for all of Illinois.

Savanna - The vegetation of Illinois often is mapped as either forest or prairie (Anderson 1970, Iverson and Joselyn 1990). In reality, the landscape of Illinois prior to European settlement was a mosaic of many different natural communities. Landscape-scale fires swept across the prairies and carried into the forests, and consequently savannas were a major feature on much of the landscape (Kline 1997, Taft 1997). However, no estimate has ever been developed for the amount of savanna that existed in Illinois in the early 1800s (Nuzzo 1986). A map for Illinois shows that the potential for presettlement oak savanna to exist over much of the IRBAA is high (Nuzzo 1986). Hence, prior to European settlement, savannas were likely a common feature in most of the landscape of the Assessment Area. Today, savannas are one of the rarest habitats in Illinois and the Midwest (Nuzzo 1986, Taft 1997).

The INAI (White 1978) identified only 1,299.2 acres of savanna in all of Illinois, mostly sand savanna. The current extent of savannas within the IRBAA is not known, although at least 4 acres (1.6 hectares) of high quality dry-mesic savanna is extant (Table 8). It is not possible to give comparisons with statewide trends, but savannas have nearly disappeared from Illinois, including this Assessment Area.

Wetlands - Natural wetlands in Illinois have declined from presettlement statewide estimates of about 23% of the land area (about 9,412,659 acres) to about 2.6% (Havera and Suloway 1994), or about 11% of the original total. Only about 6,000 acres remain in a high-quality condition (White 1978), representing about 0.65% of the remaining and 0.07% of the original wetland area. Because of the recent glacial history in the IRBAA, this area contained extensive wetlands prior to European settlement.

It is not possible to determine with accuracy the total amount of presettlement wetlands in the IRBAA. Havera and Suloway (1994) give estimates by county for presettlement

wetlands based on acreage of hydric soils. Using this information, an average percent total of wetlands for the eight counties included in the IRBAA is 19%. This translates into a very rough estimate of 106,565 acres (43,127 hectares) for presettlement wetland in the IRBAA. Today there are approximately 33,205.93 acres (13,438.4 hectares) of wetlands in the IRBAA (Table 5), or about 5.9% of the total area and 31.2% of the estimated original total. Of the wetlands currently in the Assessment Area, only about 77 acres (31.1 hectares) or 0.2% are high quality and undegraded. Included in this figure for wetlands are 5 acres (2 hectares) of tall shrub fen, which is 100% of the undegraded proportion of this natural community remaining in Illinois. About 44 acres (17.8 hectares) of high-quality seeps occur in the Assessment Area, about 46.8% of the area of undegraded seeps in Illinois. Using these coarse estimates, it appears that while extensive habitat loss and degradation have occurred, the loss and degradation of wetlands in the IRBAA is still somewhat less than in Illinois as a whole.

Vascular Plants - The IRBAA is a floristically important area, largely because of the area's ecological diversity. An incomplete species list is given in Appendix 1, with the same list sorted by scientific name in Appendix 2; nomenclature follows Mohlenbrock (1986). This list was compiled from various sources: 1) a search of the herbarium database for the Illinois Natural History Survey, 2) published literature (Brendel 1887; Evers 1955, Monoson and Schertz 1985), 3) species lists in proposals for dedications of Illinois Nature Preserves (Alesandrini 1991; Anonymous 1972, 1979; McFall 1980, 1982; Meyer 1983, 1987a, 1987b; Solecki 1989a, 1989b; Solecki and Frye 1993), and unpublished reports (Robertson and Phillippe 1992, Taft 1994, 1995a).

Based on this information, the lists in Appendices 1 and 2 contains about 996 taxa (species, subspecies, and varieties). Of these, about 791 (79.4%) are native to the IRBAA, while 205 (20.6%) have been introduced from other geographical areas and have become naturalized. Undoubtedly, a substantial number of other species occur in the IRBAA but are not included in the list as we have seen no evidence for their occurrence. The area was well botanized by Virginus H. Chase and Irene M. Cull, who made many herbarium specimens. Nevertheless, it is clear that the IRBAA has a good diversity of vascular plant species.

It is estimated that approximately 2,200 taxa of vascular plants are native in Illinois, while about 900 taxa have been introduced, giving a total of 3,100 for the state (Post 1991). A conservative estimate is that at least 34% of the total species of native and naturalized vascular plants that occur in Illinois can be found in the IRBAA. A number of plant species that occur in the IRBAA are rare elsewhere in Illinois. Most of these species are in habitats that also are rare elsewhere in the state, such as fens, sedge meadows, seeps, and glacial drift hill prairies. Due to the extensive changes in land use that have occurred in the past 150 years, several species of plants have been eliminated from the IRBAA.

Illinois Threatened and Endangered Species

A total of ten threatened and endangered (T & E) species (Table 11) currently are known to occur in the IRBAA (Herkert 1991, 1994, Illinois Endangered Species Protection Board 1994). Of these, one is federally threatened, four are state endangered, and six are state threatened. In Illinois, there are 306 plant species currently listed as state endangered and 57 listed as state threatened, thus about 1.3% of the state endangered and 10.5% of the state threatened species occur in the IRBAA. Several plant species listed as threatened or endangered appear to have been extirpated from the IRBAA and these are included in the table and text descriptions. Additional T & E plant species might be found in the IRBAA as there are several other species that occur just outside the boundaries of the Assessment Area.

The vast majority of the T & E plant species are restricted to high-quality natural communities, and thus today they are found mostly in Illinois Nature Preserves and other high-quality habitats at sites recognized by the Illinois Natural Areas Inventory (see Herkert 1997). While plant species in all official Illinois Nature Preserves are legally protected, many natural areas are in private ownership and under current Illinois law T & E plant species have no legal protection on private property.

Table 11. Threatened and endangered plant species reported from the Illinois River Bluffs Assessment Area¹.

(SE = state endangered; ST = state threatened; FT = federally threatened)

Common Name	Scientific Name	Status	Habitat
# alder buckthorn	<i>Rhamnus alnifolia</i>	SE	fens/seeps
black-seeded rice grass	<i>Oryzopsis racemosa</i>	ST	calcareous mesic forest slopes
decurent false aster	<i>Boltonia decurrens</i>	ST, FT	prairies and marshes
# forked aster	<i>Aster furcatus</i>	SE	seep zones along forest slopes
Hill's thistle	<i>Cirsium hillii</i>	ST	dry prairies
large-seeded Mercury	<i>Acalypha deamii</i>	ST	wooded floodplain terraces
# marsh horsetail	<i>Equisetum palustre</i>	formerly SE	fens/seeps
prairie dandelion	<i>Microseris cuspidata</i>	SE	dry-mesic prairies
# prairie white fringed orchid	<i>Platanthera leucophaea</i>	FT, SE	prairies
Queen-of-the-prairie	<i>Filipendula rubra</i>	ST	Fens, mesic sand prairies, seeps
Schreber's aster	<i>Aster schreberi</i>	ST	mesic upland forest
showy lady's slipper	<i>Cypripedium reginae</i>	SE	prairies, forests, barrens, bogs, fens
soft-leaved arrowwood	<i>Viburnum molle</i>	SE	forested slope, limestone bluffs
# white lady's slipper	<i>Cypripedium candidum</i>	SE	prairies, fens
yellow monkey flower	<i>Mimulus glabratus</i>	SE	calcareous seeps

¹ # indicates species that have been extirpated from the IRBAA.

Threatened and Endangered Species Currently known from the IRBAA

Large-seeded Mercury (*Acalypha deamii*) – State threatened. Large-seeded Mercury was first collected in the IRBAA by INHS botanist S. R. Hill on the west bank of the Illinois River near Mossville, Peoria County, September 1995, with another collection from nearby in 1996. A rather small, easily overlooked plant, the current status of this species in Illinois was uncertain in Illinois even in 1994 (Herkert 1994). Since then numerous populations have been found in about 10 counties in east central, west central, and southern Illinois. Typical habitat is wet wooded terraces of floodplain forests and along streams (Robertson, Levin, Phillippe 1995). The overall range of this species is Pennsylvania, Virginia, Ohio, Indiana, Illinois, Kentucky, Tennessee, Missouri, and Arkansas.

Schreber's aster (*Aster schreberi*) – State Threatened (Herkert 1991). Schreber's aster is a perennial herbaceous plant belonging to the sunflower family (Asteraceae). It has an extensive branching rhizome that leads to the formation of extensive colonies (Jones 1989) with many basal rosettes of leaves and fewer flowering stems. A plant of mesic upland forests, this aster is often found growing on north-facing slopes of ravines. Within Illinois, Schreber's aster has a narrow distribution, occurring in Will County and several counties in west-central Illinois—Bureau, Knox, Marshall, Peoria, Putnam, Rock Island, Tazewell (Herkert 1991, Illinois Department of Natural Resources 1997). This species formerly also grew in Henry County. Thus, the IRBAA, lies in the center of this species' range in the state. There are 11 Elements-of-Occurrence Records for this species in the Illinois Natural Heritage Database (Illinois Department of Natural Resources 1997), and eight of these occur in the IRBAA; hence this Assessment Area is very important for this species in Illinois. The overall range of this species is broad, from New Hampshire to Wisconsin south to Virginia, Kentucky, and Ohio (Gleason and Cronquist 1991).

Decurrent false aster (*Boltonia decurrens*) – Federally and State Threatened (United States Fish and Wildlife Service 1988, Herkert 1991). The decurrent false aster, a tall perennial herb in the sunflower family (Asteraceae). Decurrent false aster is apparently endemic to the Illinois River valley (Torrey and Gray 1841). The entire historic range of this taxon is limited mostly to the floodplain of the middle-to-lower Illinois River and near the mouth of the Illinois along the Mississippi River in Illinois and Missouri (Schwegman and Nýboer 1985). Within the IRBAA, this species is known from Marshall, Peoria, Putnam, Tazewell, and Woodford counties (Herkert 1991, Illinois Department of Natural Resources 1997). Other populations occur in Bureau, Cass, Fulton, Jersey, Madison, Mason, Morgan, Schuyler, Scott, and St. Clair counties. Of the 32 Elements-of-Occurrence Records listed in the Illinois Natural Heritage Database, 15 occur in or near the IRBAA. False decurrent aster is found scattered along the Illinois River nearly throughout its course through the IRBAA. A large population was reported by Taft (1994) in Peoria County, and a recent survey for this species north of Chillicothe (Phillippe and Larimore 1997) found a small population in Marshall County and another large, population in Peoria County.

The original habitats for the decurrent false aster included wet prairie, shallow marshes, and open river and lake shores (Schwegman and Nyboer 1985). Very little of this original habitat remains in the range of the species. This along with altered flooding patterns and duration, siltation, and probably herbicides have contributed to reductions of populations (Taft 1994). Several new colonies of decurrent false aster have been discovered in recent years, many in highly degraded habitats, and today most populations occur on disturbed ground, sometimes with a history of cultivation. Despite these new discoveries, this species is perceived to have a net population decline in recent years (Smith et al. 1993) due to the construction of numerous dams and dikes along the Illinois River. The study of Smith et al. (1993) indicates that, at least under greenhouse conditions, plants of false decurrent aster require high levels of light for optimal growth and are more sensitive to decreases in light level than to moderate drought stress. This sensitivity to light intensity may help explain the disappearance of false decurrent aster from disturbed areas after several years of natural succession, especially as plants become overtopped by other species.

Hill's thistle (*Cirsium hillii*) – State threatened. Hill's thistle is a short-lived perennial herb belonging to the sunflower family (Asteraceae); this plant is called *Cirsium pumilum* in Mohlenbrock (1986). Seeds germinate and form rosettes of purplish, prickly leaves at ground level. It appears that the plants can live for several years as rosettes, then producing one (rarely up to four) flowering shoot per rosette, which at 1–2' is rather short for a thistle (Moore and Frankton 1966). Each flowering stem produces only a few, (1–4), bright rose-pink flower heads, each containing hundreds of flowers. The globose seed heads have wind-dispersed fruits. Hill's thistle is usually a monocarpic species; it persists as basal rosettes for a few years, flowers once, then dries (Betz cited in Ostlie and Bender 1990, Robertson, Levin, Phillippe 1995).

Hill's thistle is distributed fairly widely in eastern North America, occurring in Ontario, western Pennsylvania, Ohio, Michigan, Indiana, Illinois, Wisconsin, Iowa, Minnesota, and possibly South Dakota (Moore and Frankton 1966, Gleason and Cronquist 1991). In Illinois, this species historically has been reported from at least 39 counties with about 20 extant populations known in 15 counties (Herkert 1994, Robertson, Levin, Phillippe 1995). Within the IRBAA, Hill's thistle is known from Bureau and Marshall counties. The species has undergone a decline in both numbers of individuals per population and numbers of populations (Herkert 1994).

Throughout its range, Hill's Thistle occurs in dry soils, which are often sandy but also sometimes of a loam texture. One of the common names, Pasture Thistle, seems very appropriate for this species as it is found frequently on hill prairies and hayfields with a recent occurrence of severe grazing by cattle. It appears that Hill's thistle needs some kind of disturbance to expose bare soil for seedlings to become established. Little is known on the effects of fire on Hill's thistle, and there are some concerns (Nuzzo quoted by Ostlie and Bender 1990) that fire may have deleterious effects on the long-term survival of this species. However, higher quality hill prairies should be burned, even if

Hill's thistle is present. Fire alone may remove accumulated litter, which could promote seedling establishment. Effects of fire timing is an area of needed research.

Showy lady's slipper (*Cypripedium reginae*) – State endangered. The showy lady's slipper is a perennial herbaceous member of the orchid family (Orchidaceae), and it is widely distributed in North America, occurring from Newfoundland and Quebec west to North Dakota and south to North Carolina, Georgia, and Missouri (Gleason and Cronquist 1991, Homoya 1993, Luer 1975). In Illinois, this species was once widespread, occurring in perhaps as many as 17 counties (Herkert 1991, Sheviak 1974, Winterringer 1967), including Marshall, Peoria, Putnam, Tazewell, and Woodford counties. Today, extant Illinois populations are known only in Kendall, Lake, McHenry, and Woodford counties. Within the IRBAA, only one population of the showy lady's slipper is known, occurring in a nature preserve in Woodford County; the species formerly grew within the Assessment Area in Tazewell County. Habitats preferred by this species are wet, calcareous areas, such as fens and seeps, although it once occurred in a wide variety of other mostly calcareous habitats including prairies, forested ravines, barrens, bogs, fens, and moist limestone cliffs (Herkert 1991, Sheviak 1974). Extensive habitat destruction is likely to blame for the disappearance of many populations. Even in the early 1940s, Curtis (1943) noted that the showy lady slipper was becoming quite rare in the Midwest.

A recent study of genetic diversity using allozyme variation in five North American species of *Cypripedium* (Case 1994) showed that the showy lady's slipper has very low levels of heterozygosity, with individual populations having little genetic diversity. More variation was, however, found between populations. In a study of pollinators for showy lady's slipper, Vogt (1990) found that syrphid flies and to a lesser degree flower beetles accounted for more than 90% of the pollinations in a Vermont population, although Stoutamire (1967) also reported pollination by bees. The seeds are tiny and produced in great numbers. In germination tests conducted under sterile conditions, the seeds of showy lady's slipper germinate poorly without cold stratification, but germination rate is high after stratification (Stoutamire 1992). Development from seed to mature plants was described in detail by Curtis (1943). Several years elapse between seed germination and the appearance of the first leaf above ground, and perhaps 14–16 years elapse between seed germination and first flowering.

Queen-of-the-prairie (*Filipendula rubra*) – State threatened. Queen-of-the-prairie is a tall perennial herb that forms extensive colonies from horizontal rhizomes; it is a member of the rose family (Rosaceae). Queen-of-the-prairie probably had an aboriginal distribution from Pennsylvania to Minnesota, southward to North Carolina, Georgia, Kentucky, Illinois, and Missouri, but it has escaped from cultivation in New York, New England, and Nova Scotia (Robertson 1974). Shimizu (1961) noted that *Filipendula rubra* and *F. palmata* from eastern Asia are geographically vicarious species. Preferring moist, often calcareous habitats, queen-of-the-prairie is found in wet prairies, fens, seeps, and meadows. Most populations occur in full sun, but plants can tolerate considerable shade when mature. While the overall geographical distribution is broad, populations are sparse, disjunct, and rather small in any given area. In Illinois, queen-of-the-prairie has been

known from 14 counties in the northern half of Illinois, but today it is known only from eight counties (Herkert 1991, Illinois Department of Natural Resources 1997). Within the IRBAA, this species is found in two nature preserves in Bureau and Woodford counties.

The studies of Aspinwall and Christian (1992a, 1992b) have shown that overall genetic diversity in queen-of-the-prairie is rather low, especially for a clonal but sexually reproductive plant species (the first study, 1992a, included samples from a population within the IRBAA). The plants appear to have a self-incompatible breeding type and pollinators seem numerous enough to effect pollination, yet seed production in some populations is often low. This is evidently because large clones in a population are only of one breeding type, and genetically compatible clones are widely scattered and scarce. When seed is set, even in large quantity when compatible genotypes are present, seedlings rarely become established due to severe competition from the dense growth of sedges and grasses.

This species often is cultivated for its large clusters of pink flowers (Lichman 1980) not only in gardens in North America but also in European perennial borders. While individual flowers are small, the flower clusters contain 5,000 or more massed flowers and can be 5–10 inches (12–25 cm) long, terminating numerous tall stems that can exceed 6 feet (2.4 meters) in height.

Prairie dandelion (*Microseris cuspidata*) – State endangered. The scientific names of *Agoseris cuspidata* and *Nothocalais cuspidata* are also used sometimes for the prairie dandelion. This species, a yellow-flowered stemless herbaceous perennial belonging to the sunflower (Asteraceae), was once rather widespread in Illinois, being reported from 13 counties in the northern half of Illinois. However, today this species is very rare in the state. Today, populations are known in five Illinois counties, including one in Marshall County. The prairie dandelion is mostly a western species, reaching its eastern most limit of distribution in Illinois and Wisconsin. It occurs westward to the foothills of the Rocky Mountains in Alberta, Saskatchewan, Montana, Colorado, and southward to Oklahoma (Gleason and Cronquist 1991). The original habitat for this species in Illinois was gravel and loess hill prairies; however, extensive land development, grazing, and mining for gravel has eliminated or greatly altered much of this habitat.

Yellow monkey flower (*Mimulus glabratus*) – State endangered. The yellow monkey flower is a low perennial herb in the figwort family (Scrophulariaceae) with weak, diffuse or creeping stems. This is an extremely wide ranging species, occurring through much of the Great Plains, the Great Basin, and the southwestern United States and extends southward into Mexico and northern South America; the eastward range extends into Illinois, Wisconsin, Michigan, Ontario, and Québec (Pennell 1935; Vickery 1990). Concomitant with its broad geographical range, this species is subdivided into a number of geographical races or subspecies. The plants in Illinois belong to subspecies *fremontii*. Yellow monkey flower used to occur in about 11 counties in the northern half of Illinois, but today it is known only from one population in each of four counties—Kendall, Mason, Putnam, and Woodford (Herkert 1991, Swink and Wilhelm 1994). One very

small population occurs within the IRBAA in Woodford County, with another population within a mile of the Assessment Area in Putnam County; both occur in calcareous seeps. Throughout the range of the species, most populations are small and isolated from other populations (Vickery 1990).

Black-seeded rice grass (*Oryzopsis racemosa*) – State threatened. Black-seeded grass is a perennial grass up to 3.3 feet (1 meter) tall with tufted stems from a horizontal rhizome (Hitchcock 1951). A plant primarily of northeastern North America, black-seeded rice grass extends westward to Minnesota and South Dakota. In Illinois, this plant has been reported from 13 counties in the northern half of the state, and today it occurs in 10 counties (Herkert 1991). Of the 32 Elements-of-Occurrence Records for this species in the Illinois Natural Heritage Database (Illinois Department of Natural Resources 1997), only one is from the IRBAA — a nature preserve in Bureau County (Schwegman 1991). Black-seeded rice grass occurs on calcareous slopes of mesic forested ravines, often above dolomite cliffs and ledges.

Soft-leaved arrowwood or Kentucky viburnum (*Viburnum molle*) – State endangered. Soft-leaved arrowwood is an erect shrub 4–10 feet (1.2–3 meters) tall with exfoliating bark and reddish-brown underbark much like that of a river birch (Tehon 1942). This species is found on steep wooded or often rocky slopes, especially on bluffs, escarpments, and talus slopes, along rivers and streams from Indiana and Iowa, south to Kentucky, Arkansas, and Oklahoma and also in eastern Pennsylvania (Gleason and Cronquist 1991, Steyermark 1963). In Illinois, it has been known from five counties—Adams, Brown, Clark, Marshall, Peoria, and Pike—and extant populations are still known in all except Brown and Clark counties (Herkert 1991). A total of three populations occur within the IRBAA in Marshall and Peoria counties, and these populations seem to be rather large.

Threatened and Endangered Species Extirpated from the IRBAA

Forked aster (*Aster furcatus*) – State threatened. Forked aster was collected from Tazewell County in springs at the foot of a north slope near East Peoria by Virginius Chase in 1947 and 1958 (INHS herbarium data base). Very likely this locality was in or very near the Assessment Area, but the station has presumably been destroyed. This species occurs elsewhere in Illinois in seepage zones along forested slopes and bluffs, especially north-facing ones. Suitable habitat for this species remains in the Assessment Area. Today, there are extant populations in Grundy, Kane, Kankakee, Kendall, Lake, La Salle, Lee, Mason, McHenry and Winnebago counties.

It is likely that two state endangered orchids that once occurred in the Assessment Area have been extirpated. The first is white lady's slipper (*Cypripedium candidum*). A herbarium specimen was collected in 1939 near Henry, Marshall County, and the records from Peoria County "were probably collected wholly or in part in Tazewell or Woodford County" (Sheviak 1974). The second is prairie white fringed orchid (*Platanthera*

leucophaea), which is also listed as federally threatened. There are three undated herbarium specimens collected in the vicinity of Peoria (Sheviak 1974).

Alder buckthorn (*Rhamnus alnifolia*) – State Endangered. The alder buckthorn has been collected at Spring Mill Bog in Tazewell County, the last time by Virginus Chase in 1951 (University of Illinois herbarium). Currently, this species is known in Illinois only from two populations in Kendall County, although it formerly occurred in Kane, Lake, and McHenry counties. Supposedly, there is a collection of this species in the herbarium of the Morton Arboretum collected by Runde in 1971 in a thicket west of Peoria.

Marsh horsetail (*Equisetum palustre*) – Delisted and believed extirpated from Illinois, formerly State endangered (Herkert and Kruse 1992). The marsh horsetail was known in Illinois only from what was called “Spring Mill Bog,” north of East Peoria in Tazewell County (although sometimes the county is erroneously given as Woodford or Peoria); the record of this species from Kankakee County is a misidentification. The last collection of this species in Illinois was by Virginus Chase in 1953 (University of Illinois herbarium). Attempts to relocate the species in 1988 were unsuccessful (Bowles et al. 1991), and the species appears to have been extirpated from the state. The Spring Mill Bog locality was once botanically very interesting, with a number of fen and seep plants, including: brown fox sedge, fowl manna grass, green orchid, leafcup, lizard’s tail, marsh bellflower, marsh fern, marsh marigold, nannyberry, prickly sedge, Queen-of-the-prairie, rice cutgrass, showy lady’s slipper, skunk cabbage, small spikemoss, soft-stemmed bulrush, spotted Joe-Pye weed, swamp aster, swamp saxifrage, swamp thistle, sweet scented bedstraw, water parsnip, and waxy meadow rue (INHS herbarium database). This site was degraded when examined by Taft (1995a) and has subsequently been destroyed.

There are several reasons for species being rare and consequently listed as Endangered or Threatened in Illinois (Taft 1995b). These include the following examples. (1) The species are naturally sparse or infrequently occurring, probably even prior to European settlement. Queen-of-the-prairie and yellow monkey flower are examples. (2) The species occur in Illinois at the edge of their natural geographical range and are found primarily in a few counties at the border of the state. This is the situation with the majority of T & E species in the IRBAA. These species are common, often abundant, in areas to the north, south, east, or west of Illinois. An example is prairie dandelion. (3) The populations that occur in Illinois are geographically separated, or disjunct, from the principal range of the species. Species with this pattern are absent from the IRBAA; some examples for Illinois include leafy prairie clover, silvery bladderpod, and Tennessee milk vetch. (4) Species are restricted or endemic to Illinois and do not occur elsewhere. Only two species are considered endemic to Illinois — Kankakee mallow in Kankakee County and thismia, originally found in southeastern Cook County and now thought to be extinct. However, decurrent false aster is essentially endemic to Illinois, being found in Missouri near the mouth of the Mississippi River. (5) Habitat degradation caused by human-induced activities such as gravel or peat mining, soil scraping, grazing by livestock, and the introduction of aggressive non-native species that often can replace native species. (6) Disruption of ecological processes including fires resulting in ecological changes in fire

dependent community types. (7) Habitat destruction, primarily due to the conversion of the land for agricultural and urban uses. The latter reason is the ultimate cause for rarity of native organisms in Illinois, and this impact will undoubtedly be exacerbated within the IRBAA in the near future as the area currently is undergoing a great increase in urban sprawl. These causes collectively have lead to the elimination or extirpation of a number of species from the IRBAA. In addition, the number of individuals of many species, particularly T & E taxa (Table 11), have been reduced by these activities and this may lead to further loss of species as population size may be too low for species to sustain themselves.

Disturbance, Habitat Quality, and Restoration Potential

In addition to habitat loss through conversion to agricultural and urban areas, as well as extraction of gravel and peat deposits, most remnant plant communities in the IRBAA have experienced human induced disturbances that have resulted in differing levels of degradation. The absence of landscape scale fires, fragmentation of once large expanses of natural habitat into small isolated fragments, and the introduction of non-native, exotic species into natural habitats are other consequences typical of intensive habitat conversion that have implications for habitat restoration potential. These issues are discussed below.

Disturbance is a general term referring to any perturbation. Plant communities (or ecosystems) are *degraded* when recovery to original condition is unlikely under normal circumstances. Degraded lands can be distinguished further by those that can be *restored* to original condition through management efforts and those which, at best, can be *reclaimed* for only limited use in severe examples (e.g., strip mining), or *rehabilitated* to a condition somewhat similar to the original but where compositional differences remain (Lovejoy 1975). Degraded lands are *derelict* when land uses become very limited (Brown and Lugo 1994). Perturbations that exceed the intensity, frequency, or duration of the natural disturbance regime can result in loss of species lacking tolerance or adaptations to the new levels. When certain “keystone” species, or assemblages of other taxa, are extirpated from a community, the system’s capability for restoration is diminished and integrity is lowered. A common source of degradation in Illinois plant communities is overgrazing by livestock (Dennis 1997) or deer (Anderson et al. 1995; Anderson 1997); however, multiple factors often are interacting.

Fire is an example of a large-scale natural disturbance in many midwestern plant communities and fire frequency is an important determining factor for many community characteristics. The compositional and structural characteristics of many native Illinois plant communities demonstrate some level of fire dependency. Fire absence in these communities can result in profound changes in community characteristics. For example, vegetational changes common throughout Illinois such as from prairie to shrub thicket or forest, or oak-dominated woodland to maple-dominated forest, are attributable to reduced fire frequency and fire absence (Anderson 1982, Nuzzo 1986, Ebinger 1997, Robertson et al. 1997, Taft 1997).

Fragmentation is a process describing landscape patterns where habitat remnants become isolated by land conversions (Wilcove et al. 1986, Schwartz 1997). Fragmented habitats often undergo alterations in many environmental conditions. Increased surface area of edge compared to volume can result in changes in soil moisture conditions and levels of solar radiation, as well as increased opportunity for exotic species invasions (Luken 1997) and wind damage (Gelhausen et al., in review). High levels of fragmentation limit restoration potential of degraded sites since species immigration, needed to compensate for the local extirpations of plants with low population levels, is seriously challenged (Taft 1996, 1997). Fragmented habitats support fewer species and at lower population levels compared to less fragmented habitats. Species at lower population levels are prone to local extirpation. Native browsing animals, such as deer, can also have great impact in highly fragmented habitats (Anderson 1997), and the impact of overgrazing by livestock is exacerbated in habitat fragments (Dennis 1997).

Integrity is lowered not only by the loss of native species, but also by the introduction of non-native (exotic, adventive) species. Adventive taxa in a system may be sorting into disturbance or habitat niches that result in the replacement of native taxa (Solecki 1995, 1997; Luken 1997). The establishment of adventive taxa can result in arrested development and interfere with rates of recovery processes. The recovery potential of plant communities with appropriate ecological restoration and management is an area much in need of additional research. Specific and general recommendations for restoration of natural communities in the IRBAA, including exotic species control measures, are offered in the "Summary and Recommendations" section following the descriptions of Natural Communities (also see Cole 1991; Glass 1991, 1992; Heidorn 1991; Illinois Nature Preserves Commission 1990; Kennay and Fell 1992; McKnight 1993; Nuzzo 1991; Solecki 1989c, 1995, 1997; Thompson et al. 1987).

Natural Areas and Nature Preserves

The Illinois Natural Areas Inventory (INAI) was conducted by the University of Illinois, the Natural Land Institute, and the Illinois Department of Conservation over a three-year period during the mid 1970s to document remaining significant and exceptional examples of the natural communities in Illinois (White 1978). The INAI established seven categories of natural areas based on significant features. The categories are: I - High-quality Natural Communities; II - Habitat for Endangered Species; III - Habitat for Relict Species; IV - Outstanding Geological Areas; V - Approved Natural Areas and Restoration Sites; VI - Unique Natural Areas; and VII - Outstanding Aquatic Areas. The INAI established a grading system to designate natural quality (White 1978; White 1981a, b, c). The natural quality of a natural community was graded from "A" (relatively stable or undisturbed) to "E" (very early successional or severely disturbed). Grade E was reserved for cropland or other highly developed lands. In general only "A" and "B" communities are designated as significant or exceptional features, although areas included on the Natural Areas Inventory often include substantial amounts of grade C natural communities.

Within the IRBAA, 29 sites qualify as high-quality natural areas for the INAI (Table 7, Figure 13), totaling 2,459.12 acres (995.21 hectares). While this amount represents only 0.4% of the total area of the Assessment Area, it is quite a high figure for central Illinois. A number of natural communities are included with these natural areas: upland forest; bottomland forest; blacksoil, gravel, and sand prairie; savanna; marsh; tall shrub fen; and seeps. In addition, lower quality natural communities of these and other types can be found, or used to occur, in some of these natural areas. Table 12 summarizes all the natural communities of the IRBAA.

Table 12. Terrestrial natural communities known to occur or believed to have formerly occurred in the Illinois River Bluffs Assessment Area¹.

FOREST

Upland forest

dry upland forest
dry-mesic upland forest
mesic upland forest
wet-mesic upland forest

Floodplain forest

mesic floodplain forest
wet-mesic floodplain forest
wet floodplain forest

WETLAND

Marsh

marsh

Fen

tall shrub fen

Sedge meadow

sedge meadow

Seep & Spring

seep
calcareous seep

PRAIRIE

Prairie

dry-mesic prairie
mesic prairie
wet-mesic prairie
wet prairie

Hill prairie

glacial drift hill prairie

LAKE AND POND

Pond

pond

Lake

lake

CULTURAL

prairie restoration
wetland restoration

SAVANNA

Savanna

dry-mesic savanna
mesic savanna
wet-mesic and wet savanna

¹ Adapted from the Illinois Natural Areas Inventory's natural community classification (White and Madany 1978).

While areas included on the Natural Areas Inventory within the IRBAA contain 2,459.1 acres, only 500.9 acres (202.7 hectares) are of grades A and B natural quality, which is 0.09% of the total area or slightly above the state-wide average of 0.07% (White 1978). Of the 500.9 acres, 33.5 acres (13.5 hectares) are grade A and 467.4 acres (189.2 hectares) grade B. Relatively undegraded (Grades A and B) remnants of several natural communities are present in the assessment area, including: dry-mesic upland forest, mesic upland forest, glacial drift hill prairie, mesic savanna, dry-mesic savanna, marsh, tall shrub fen, and seep (Table 8). Particularly significant in terms of relative abundance for certain community types in Illinois is that 100% of the high-quality tall shrub fen, 55.6% of glacial drift hill prairie, 46.6% of seep, and 43.5% of the undegraded dry-mesic savanna remaining in Illinois occur in the IRBAA.

Nature preserves are areas of land or water in public or private ownership that are formerly dedicated to receive maximum protection of significant natural features. The central goal of the nature preserve system, currently with about 250 preserves in the state, is to protect and preserve examples of all significant natural features found in Illinois for the purposes of scientific research, education, conserving biodiversity, and esthetic enjoyment. Nature preserves are administered largely by the Illinois Nature Preserves Commission (INPC). Preserves usually are the shared responsibility of the INPC, the Illinois Department of Natural Resources, and land owners (McFall and Karnes 1995).

A relatively high number of Illinois Nature Preserves occur in the IRBAA (Table 9, Figure 13), with 11 sites totaling 1,300.1 acres (526.2 hectares). Many of these nature preserves are quite small, representing mere fragments of once large natural communities; however, these are still important for conservation (Schwartz and van Mantgem 1997). Since Peoria the largest city in downstate Illinois, the IRBAA faces many problems in the urban/rural interface; Shafer (1997) discusses the design of nature reserves in this context.

As mentioned above, many of the state's nature preserves are publically owned. In addition, there are several state owned lands and one federally owned area in the Illinois River Bluffs Assessment Area (Table 6, Figure 12) all devoted to conservation purposes such as hunting and fishing. The Illinois River State Fish and Wildlife Area contains 1,657 acres (671 hectares). Altogether, there are four State Conservation Areas totaling 7,818 acres (3,164 hectares). The Cameron-Billsbach National Wildlife Refuge has 1,622 acres (656 hectares).

Terrestrial Natural Community Descriptions

This discussion of natural communities follows the classification system developed by the Illinois Natural Areas Inventory (White and Madany 1978). The natural communities within the IRBAA (Table 12) were determined by examining data from several sources. These include descriptions of existing community types as well as plant communities inferred to have occurred prior to European settlement and large-scale alteration of the landscape. Botanical nomenclature follows Mohlenbrock (1986). Scientific names

corresponding to the common names used in this text are in the summary species list for the IRBAA (Appendix 1). These taxa are sorted by scientific name in Appendix 2.

Specific data sources used include species lists from known community types found in INAI sites and descriptions of vegetation in publications and technical reports. Compared to some other parts of Illinois, there are very few books or papers published in the scientific literature, recent or historic, that describe natural communities in west central Illinois. A general description of the vegetation as it existed more than 100 years ago is given by Brendel (1887). The hill prairies were studied by Evers (1955); one hill prairie was included in studies published by Robertson and Schwartz (1994), Robertson et al. (1995), and Schwartz et al. (1997); and one prairie was surveyed by Betz and Lamp (1989). In the preparation of this report, the natural area files in the herbarium of the Illinois Natural History Survey were invaluable, especially notes prepared by Robert A. Evers, Survey botanist from 1947 to 1975, and documents prepared for the Illinois Nature Preserves Commission (Alesandrini 1991; Anonymous 1972; Meyer 1983, 1987 a, b; Natural Areas Section 1972; Solecki 1989 a, b; and Solecki and Frye 1993).

The general types of natural communities found in official Illinois Nature Preserves are given in *A Directory of Illinois Nature Preserves* (McFall and Karnes 1995). General descriptions of many habitats occurring in Illinois can be found in Evers and Page (1977) and Jeffords et al. (1995). Additional published references are given below under specific communities.

Forest

Forests in the IRBAA belong to the Prairie Peninsula Section in the Northern Division of the Oak-Hickory Forest Region (Braun 1950). As seen in Table 2, the amount of presettlement forest landcover varied considerably in different regions within the IRBAA, from 15.3% in La Salle County to 46.8% in Peoria County. Prior to European settlement, landscape-scale fires generally moved from west to east, driven by the predominantly western prevailing winds. Land on the west sides of streams burned regularly, often limiting the development of forests, while the streams, and the topographic relief associated with them, served as fire breaks, allowing the development of forest on their east sides. Within the IRBAA, some of the areas mapped as being in forest prior to European settlement (Anderson 1970, Iverson and Joselyn 1990) were in fact savanna. Subsequent to European Settlement, landscape-scale fires were suppressed and oak savannas quickly developed into oak forests (Kilburn 1959, Nuzzo 1986, Packard and Mutel 1997b). See the discussion below on savannas.

General ecological problems frequently associated with forest communities include habitat degradation, fragmentation, the introduction of non-native plant species, and fire absence, especially in upland forests. A typical source of habitat degradation in forests is over-grazing, not only by domestic livestock but also by white-tailed deer which have increased substantially in numbers recently (Anderson 1997). This grazing often produces

changes in forest compositional and structural characteristics. Like in much of Illinois, grazing-sensitive species probably have been eliminated from many forest remnants in the IRBAA. In contrast, species that increase with grazing often are abundant in over-grazed forest remnants (e.g., thorn-bearing taxa such as red haw, honey locust, Missouri gooseberry, and blackberries/raspberries). Some non-native species also increase in abundance with over-grazing, such as multiflora rose, bush honeysuckles, and garlic mustard, as well as certain weedy native species, such as buckbrush and poison ivy. In many cases, the abundance of exotic species appears to be directly proportional to the historic grazing intensity. Recovery of these sites following cessation of grazing appears to be slow. Complete restoration may not be possible without intensive management including species reintroduction. Fire absence in upland forest communities typically results in compositional changes in more mesic sites (such as increase in abundance of sugar maple) and primarily structural changes in drier sites (such as increases in stem density of woody plants and shade). The result is often a reduction in cover and diversity of the herbaceous ground flora, typically the most diverse stratum in Illinois woodlands (e.g., Taft et al. 1995).

Within the IRBAA and other parts of northern Illinois, non-native plant species are severe threats to the integrity of forest communities. In the herbaceous layer, the abundance of garlic mustard has increased dramatically in the past 20 years (Nuzzo 1991), and unfortunately the native spring woodland wildflowers in many areas largely have been eliminated by the spread of this species. The shrub layer can contain a number of non-native species, such as several different kinds of bush honeysuckles, multiflora rose, European highbush cranberry, and common buckthorn. The canopy layer can also include non-native tree species, such as black locust and Osage orange.

Several endangered and threatened species of plants occur in forests in the IRBAA. These include black-seeded rice grass, Schreber's aster, and soft-wooded arrowwood (Table 11).

Forest subclasses in Illinois include upland forest, sand forest, floodplain forest, and flatwoods. Only upland forest and floodplain forest are known to occur in the IRBAA. These forest types are characterized below.

Upland Forest

The total extent of upland forest today in the IRBAA is about 77,378 acres (31,315 hectares), or 13.8% of the total land cover (Table 4). Of this, 401 acres (162 hectares) are high-quality natural areas recognized by the INAI (Table 8). Upland forest communities can be classified further by soil-moisture characteristics. Dry, dry-mesic, mesic, and wet-mesic upland forest communities are recognized in Illinois in context with increasing available soil-moisture (White and Madany 1978). Major tree species respond in predictable ways along these soil-moisture gradients (Adams and Anderson 1980, Clausen 1970, Fralish 1994, Taft et al. 1995). The major ecological problems associated with upland forests are degradation from grazing, habitat fragmentation, and the spread of non-native species (see list above). The following paragraphs describe the upland forest community types that occur in the IRBAA.

Dry upland forest – Dry upland forests are occasional to common on ridge crests and upper slopes with dry exposures (south and southwest-facing aspects) and are most common in, and possibly restricted to, the western portion of the Assessment Area. Few remnants of dry upland forest in the IRBAA have been described in detail. No dry upland forest remnants have been identified that meet the qualitative criteria for inclusion in the Illinois Natural Areas Inventory.

The dominant canopy species in dry upland forests are white oak and black oak. Occasional to common species include, chinquapin oak, and shagbark hickory. Subcanopy trees include shadbush, flowering dogwood, hop hornbeam, redbud, and red cedar. Shrubs include rough-leaved dogwood, aromatic sumac, smooth sumac, pasture rose, nannyberry, and hazelnut. Common woody vines include Virginia creeper and poison ivy. Characteristic ground-cover species include pussy toes, sedges (e.g., *Carex pensylvanica*, *C. artitecta*, *C. cephalophora*, *C. hirsutella*, *C. rosea*), poverty oat grass, soft agrimony, hog peanut, tall anemone, sicklepod, whorled milkweed, ebony spleenwort, blue aster, pale Indian plantain, common mullein, shooting star, woodland sunflower, hairy hawkweed, slender bush clover, purple oxalis, common cinquefoil, and hairy mountain mint. Several prairie/savanna species can be present in forest openings including cylindric blazing star, big bluestem, little bluestem, yellow stargrass, and flowering spurge. This community type in pre-European settlement times probably locally graded into savanna/barrens habitats. Canopy composition of this community type is relatively stable since mesophytic species like sugar maple would be limited by the dry soil-moisture conditions. However, structural characteristics of the community can change with long fire-free intervals as oak and hickory species tolerant of dry conditions typically increase in density.

Dry-mesic upland forest – This community type, the most prevalent forest community in Illinois, occurs in the IRBAA on the upper to middle slopes and ridges of the dissected terrain bordering the Illinois River and on the slopes and sides of ravines. Within the IRBAA, 144 acres (58 hectares) of Grade B sites are present (Table 8). This represents 6.9% of all Grade B dry-mesic upland forest in Illinois and 4.7% of all Grades A and B sites in the state.

Dominant canopy species are white oak, black oak, shagbark hickory, and white ash. Occasional tree species include red oak, chinquapin oak, shingle oak, shagbark hickory, pignut hickory, and sweet pignut hickory. Common subcanopy species include sugar maple, shadbush, blue beech, hop hornbeam, redbud, flowering dogwood, red mulberry, black cherry, wafer-ash (alkaline sites), and slippery elm. Typical shrubs include rough-leaved dogwood, hazelnut, Iowa crabapple, Missouri gooseberry, black raspberry, aromatic sumac, black haw, and nannyberry. Common to occasional woody vines include Virginia creeper, poison ivy, bittersweet, bristly greenbrier, riverbank grape and summer grape. Characteristic herbaceous species include pussy toes, Virginia snakeroot, whorled milkweed, ebony spleenwort, blue aster, rattlesnake fern, soft agrimony, sicklepod, tall anemone, pale Indian plantain, black grama, sedges (e.g., *Carex artitecta*, *C. pensylvanica*, *C. rosea*, *C. cephalophora*, *C. hirsutella*), toothwort, red trillium, wild

geranium, spring beauty, late coral root orchid, poverty oat grass, shooting star, smooth sweet cicely, woodland sunflower, rock satin grass, false Solomon's seal, elm-leaved goldenrod, and early horse gentian.

The major ecological problems associated with dry-mesic upland forests are degradation from grazing, habitat fragmentation, and fire absence. Fire absence can lead towards an increased importance of sugar maple in the subcanopy stratum and potentially lesser importance of oaks in the canopy. Where oaks have been removed by selective logging practices, black cherry, shagbark hickory, slippery elm, and possibly sugar maple are among the species that gain prominence in the canopy. Exotic species in dry-mesic upland forest include garlic mustard, tree-of-heaven, Amur honeysuckle, and autumn olive.

Mesic upland forest – When soil moisture is sufficient, mesic upland forests develop, which have a dense canopy, an understory of shade-tolerant woody species, and a rich variety of spring woodland wildflowers. In the IRBAA this type of forest is concentrated on the lower-to-mid slopes of the dissected terrain associated with the major streams and tributaries, especially on north and east aspects and in protected locations of west exposures. Mesic forest occurs occasionally as isolated remnants of former larger blocks of forest. A total of 21 acres (8.5 hectares) of Grade A and 236 acres (95.5 hectares) of Grade B mesic upland forest within the IRBAA is recognized by the INAI for a total of 257 acres (104 hectares). This is about 10.2% of the high quality mesic upland forest remaining in Illinois (Table 8).

Characteristic canopy species include sugar maple, red oak, bur oak, and basswood. There is a rich mixture of other trees in this community, such as shagbark hickory, bitternut hickory, American elm, slippery elm, white oak, chinquapin oak, hackberry, black walnut, black cherry, white ash, and blue ash. Subcanopy species include Ohio buckeye, shadbush, red mulberry, paw paw, blue beech, and hop hornbeam. Typical shrubs include elderberry, alternate-leaved dogwood, redbud, wahoo, black haw, bladdernut, wild hydrangea, buckbrush, prickly-ash, wafer-ash, wild plum, common chokecherry, American black currant, and Missouri gooseberry. Woody vines include poison ivy, Virginia creeper, grape honeysuckle, and riverbank grape. Herbaceous species composition includes a rich assortment of species, particularly spring ephemerals, including American spikenard, yellow bellwort, black snakeroot, bloodroot, blue cohosh, broadleaf goldenrod, Christmas fern, wild columbine, woodland phlox, common snakeroot, doll's eyes, downy-blue violet, Dutchman's breeches, dwarf larkspur, enchanter's nightshade, false rue anemone, false Solomon's seal, fragile fern, ginseng, goldenseal, green dragon, green violet, early horse gentian, Jack-in-the-pulpit, large twayblade orchid, late figwort, late goldenrod, leafcup, liverleaf, maidenhair fern, mayapple, nodding trillium, putty-root orchid (rare), rattlesnake fern, red trillium, rue anemone, several sedges (e.g., *Carex albursina*, *C. hirsutella*, *C. jamesii*, *C. rosea*), shining bedstraw, smooth ruellia, smooth scouring rush, Solomon's seal, spotted touch-me-not, spring beauty, hairy and smooth sweet Cicely, tall bellflower, Virginia bluebells, Virginia waterleaf, white avens, white snakeroot, declined trillium, white trout lily, wild balsam apple, wild geranium, wild ginger, wild leek, wild yam, and wood anemone.

Wet-mesic upland forest – No examples of this community type are known to occur within the IRBAA. Typically, wet-mesic upland forest occurs where there are localized drainage limitations within an upland forest, and such conditions are possible in the IRBAA. Often, drainage is limited by a slowly permeable subsoil horizon. Local areas of seepage may contribute to locally saturated soils and can support this natural community. Where depressions occur in an upland forest, ponding may occur for variable periods. Some of these may now be characterized by poor drainage and locally support a wet-mesic upland forest community. Characteristic canopy species include swamp white oak. A subcanopy often is absent. Ground-cover species may include a few wetland sedge and shrub species.

Floodplain Forest

Floodplain forests are characterized by edaphic conditions of poor drainage and slow permeability. Local areas of sand and gravel increase permeability. Floodplain forest communities in Illinois include mesic, wet-mesic, and wet floodplain forest and are classified according to characteristics of flooding. Wet floodplain forest occurs in the floodplain bordering rivers including the riverbank. Wet-mesic to mesic floodplain forests occur on low to high terraces, respectively. Based on the Land Cover database (Table 4), the total extent of floodplain forests in the IRBAA is estimated to be 13,919 acres (5,633 hectares) while the Wetlands Inventory Database lists 11,595.36 acres (4,692.64 hectares) of bottomland forest and 60.03 acres (24.29 hectares) of swamp in the Assessment Area. None of this is considered to be high-quality habitat by the INAI. Most of this floodplain forest is along the broad floodplain of the Illinois River.

Endangered and threatened plants in floodplain forest include large-seeded mercury and false decurrent aster. Glade mallow, rare in Illinois although not listed as endangered or threatened, occurs in open areas on floodplain terraces along the Illinois River in Marshall, Peoria, and Putnam counties, along Crow Creek in Marshall County, (Robertson and Phillippe 1992).

In general, the flooding regime, including depth and duration of flooding, is a strong selective force on composition and species richness in floodplain forests (Bell 1974) and also in regulating tree growth (Robertson 1992). Wet floodplain forests are often seasonally flooded and/or have perched water during a portion of the year, often in late winter and spring. Generally, flooding is of shorter duration and less frequency in mesic floodplain forests. Wet-mesic floodplain forests are intermediate in flood duration. Diversity of species composition tends to increase from wet to mesic floodplain forest. Considerable tree mortality occurred in the floodplain of the Illinois and Mississippi rivers following an extensive inundation period associated with severe flooding in 1993. In general, trees and shrubs typically found in the wet floodplain forest zone were most tolerant of flooding (e.g., silver maple, cottonwood, sycamore, box elder, buttonbush, green ash, willows) while many species associated with the mesic floodplain forest zone were intolerant (e.g., bitternut hickory, sugarberry, hackberry, redbud, walnut, red

mulberry, black cherry, white oak, red oak, basswood) and experienced high rates of mortality (Yin et al. 1994, 1997, Yin and Nelson 1995). Mortality increased from upper reaches of the Mississippi River to the confluence with the Illinois River where 32% of the mature trees and 80% of the shrubs died. Younger trees were particularly vulnerable to mortality (Yin et al. 1994).

Post-settlement changes in the watersheds and water quality of the Illinois and Mississippi rivers have been extensive and include conversion of a large portion of the basins into erosion-prone row crops, the establishment of levees and flow-through dams along the rivers, and discharge of water from the Chicago drainage canal into the Illinois River basin (Turner 1934, 1936). These changes have produced dramatic compositional changes of the vegetation in floodplain natural communities (Nelson et al. 1994). Former to these human induced modifications, prairies occupied about 40% of the lower Illinois River floodplain; however, the prairies were destroyed for agriculture. The floodplain forests formerly were comprised of a diverse mixture of tree species; currently, silver maple, a silt and flood-tolerant species, has become strongly dominant far exceeding all other species in abundance (Nelson et al. 1994). Current ecological problems in floodplain forest include siltation from silt-laden flood waters, changes in the hydrological regime (e.g., stream entrenchment of tributary streams or increased flooding duration and frequency of the major streams due to changes in the upper watershed), and exotic species invasion. Below are descriptions of the composition and structure of floodplain forests that could occur in the IRBAA.

Mesic floodplain forest – No areas have been identified from within the IRBAA by the Illinois Natural Areas Inventory (INAI) as high-quality, undegraded remnants of mesic floodplain forest. Compared with the wet floodplain forest community, a relatively greater diversity of tree species often can be found in examples of this high terrace forest since the relatively brief flooding duration and lower flooding frequency pose fewer limitations to species. Common to occasional canopy tree species include sugar maple, black walnut, white oak, bur oak, chinquapin oak, basswood, and American elm. Subcanopy species include Ohio buckeye, red mulberry, persimmon, and slippery elm. Shrubs and vines include: paw paw, redbud, Missouri gooseberry, bladdernut, prickly ash, Virginia creeper, bristly greenbrier, poison ivy, and riverbank grape. Ground-cover species include many taxa also found in mesic upland forests: doll's eyes, wild ginger, Jack-in-the-pulpit, spring beauty, enchanter's nightshade, leather flower, hairy and smooth sweet Cicely, honewort, toothwort, Virginia waterleaf, Virginia blue bells, woodland phlox, mayapple, Solomon's seal, bloodroot, black snakeroot, false Solomon's seal, and downy-blue violet.

Ecological problems include altered flooding regime, over grazing, and exotic species invasions. The severe flooding of 1993 resulted in relatively greater mortality among mesic floodplain forest species compared with species of wet floodplain forest (Nelson et al. 1994). Exotic species typically associated with mesic floodplain forest include Osage orange, white mulberry, and multiflora rose.

Wet-mesic floodplain forest – No areas have been identified from within the IRBAA by the Illinois Natural Areas Inventory (INAI) as high-quality, undegraded remnants of wet-mesic floodplain forest. Common to occasional canopy species include silver maple, bitternut hickory, hackberry, honey locust, green ash, black walnut, pin oak, and American elm. Subcanopy species include box elder, sugarberry, red haw, red mulberry, persimmon, Kentucky coffeetree, and slippery elm. Shrubs and Vines include paw paw, Missouri gooseberry, common blackberry, elderberry, bristly catbrier, poison ivy, and riverbank grape. Ground-cover species include giant ragweed, false nettle, several sedges (e.g., *C. davisii*, *C. grisea*, and *C. granularis*), wild chervil, enchanter's nightshade, honewort, Aunt Lucy, Virginia wild rye, annual bedstraw, white avens, cow parsnip, Virginia waterleaf, wood nettle, Virginia blue bells, woodland phlox, goldenglow, black snakeroot, common snakeroot, and cup plant. Ecological problems include changes in the watershed that alter the flooding regime, severe grazing, and exotic species introductions. Exotic species include moneywort, Osage orange, white mulberry, and multiflora rose. Garlic mustard, an extremely invasive exotic species, often invades moist, shaded woodlands such as wet-mesic floodplain forests (Nuzzo 1991). This species currently is a major concern in northeastern and central Illinois where it has invaded, become locally abundant, and evidently replaces many native species. With the potential for exponential growth of populations of this species over short time periods (Nuzzo 1991), new populations should be eliminated immediately before satellite populations form and it becomes virtually uncontrollable.

Wet floodplain forest – No areas of wet floodplain forest from the IRBAA are included in the INAI. Compared with other floodplain forest communities, fewer tree species can be found in examples of this natural community since flooding frequency and duration, typically, are limiting for many species. Common to occasional canopy species include: silver maple, hackberry, green ash, honey locust, sycamore, and cottonwood. Subcanopy species include box elder, Kentucky coffeetree, river birch, and black willow. Shrubs and woody vines include elderberry, bristly catbrier, trumpet creeper, poison ivy, and riverbank grape. Ground-cover species include giant ragweed, panicked aster, wood nettle, false nettle, stinging nettle, dodder, blue lobelia, honewort, Virginia wild rye, annual bedstraw, white avens, spotted touch-me-not, Virginia blue bells, clearweed, goldenglow, and woundwort. Ecological problems include changes in the watershed that alter the flooding regime and exotic species introductions. Exotic species include creeping Charlie, moneywort, and Osage orange.

Prairie

Prairies are plant communities dominated by herbaceous plants, especially grasses; trees are either absent or only widely scattered on the landscape. Illinois lies within an area called the "prairie peninsula," an eastward extension of prairies that borders deciduous forests and woodlands to the north, east, and south. This is part of the tallgrass prairie region, sometimes called the true prairie, with the landscape dominated by grasses such as big bluestem and Indian grass as well as a large number of other species of grasses and

wildflowers, the latter called forbs. The vegetation sometimes reaches a height of 10 feet or more (Anderson 1991a, Risser 1984, Risser et al. 1981, Robertson and Schwartz 1994, Robertson et al. 1997, Steinauer and Collins 1996).

Tallgrass prairie is a recently developed ecosystem in North America, formed after the period of Pleistocene glaciation (Axelrod 1985). About 18,000 years ago, northeastern Illinois was covered by glaciers. As the glaciers melted, the land was covered at first with tundra-type vegetation, then by spruce forests. As the climate became warmer and drier, between 14,000 and 10,000 years ago, a cool-mesic hardwood forest with ash, oak, elm, maple, birch, and hickory trees replaced the spruce forest. About 8,300 years ago, the climate became substantially warmer and drier, and within the relatively short time of 500 to 800 years, forests in Illinois became restricted to protected sites such as along stream banks, while prairies increased over the landscape. During the last 1,000 years, the climate has become slightly cooler and more moist, making conditions more favorable to trees.

Prairies developed and were maintained under the influence of three major stresses: climate, grazing, and fire. Occurring in the central part of North America, prairies are subject to extreme ranges of temperatures, with hot summers and cold winters. There are also great fluctuations of temperatures within growing seasons. Rainfall varies from year to year and within growing seasons as well. The prairie region is also subject to droughts. Usually there is a prolonged dry period during the summer months, and there are major droughts lasting for several years that occur every 30 years or so. Prairie fires, started by Native Americans and lightning, were common before European settlement. Many plant communities burned frequently, perhaps once every one to five years. These prairie fires moved rapidly across the landscape, and damaging heat from the fire did not penetrate the soil to any great extent. Fire kills most saplings of woody species, removes thatch aiding in some nutrient cycling, and if timed during the dormant season promotes early flowering spring species. A considerable portion of the above ground biomass of a prairie was consumed each year by the grazing of a wide range of browsing animals, such as bison, elk, deer, rabbits, and grasshoppers. This grazing was an integral part of the prairie ecosystem, and to grasslands in general. Grazing increases growth in prairies, recycles nitrogen through animal wastes, and the trampling by herds opens up habitat for plant species that prefer some disturbance of the soil.

Prairie plants have adapted to these stresses by a variety of means. Many species are herbaceous perennials with underground storage/perennating structures, growing points slightly below ground level, and extensive, deep root systems. The tender growing points of prairie plants occur an inch or so below ground and are usually not injured by prairie fires. These underground growing points are also left unharmed by browsing animals. During droughts, the extensive roots of prairie plants are able to take up moisture from deep in the soil since roots of prairie plants often extend deeper into the ground than the stems rise above it. For instance, the roots of big bluestem may be 7 feet or more deep, and switchgrass roots more than 11 feet deep. Some of the roots die and decompose each year, and this process has added large quantities of organic matter to the soil. This is one

reason why the prairie soils are so fertile for agriculture. In agricultural terms, the tallgrass prairie sustains high productivity while building and maintaining soil (Chapman et al. 1990).

The tallgrass prairie is "the most diverse repository of species in the Midwest [and]...habitat for some of the Midwest's rarest species" (Chapman et al. 1990). Yet, it is well known that North American grasslands, especially the tallgrass prairie, are among the most endangered habitats in the world (Klopatek et al. 1979, Crumpacker et al. 1988, Chapman et al. 1990, Noss and Cooperrider 1994, Noss et al. 1995). As noted by Chapman et al. (1990), the tallgrass prairie is 99% destroyed east of the Mississippi River, and south and west of the Missouri River it is 85% destroyed. This led Noss et al. (1995) to include the tallgrass prairie east of the Missouri on his list of "Critically Endangered Ecosystems" of the United States. Only 0.01% of the original prairie in Illinois is still extant in an undegraded condition, and only 0.005% of that in the IRBAA.

Following the natural community classification of the INAI (White and Madany 1978), 6 subclasses of prairie are recognized in Illinois: *prairie* (= black soil, silt-loam prairie), *sand prairie*, *gravel prairie*, *dolomite prairie*, *hill prairie*, and *shrub prairie*. Further divisions are made based on soil moisture classes yielding 23 prairie community types in Illinois. Prior to European settlement, it is estimated that 62.3% of the Assessment Area was in prairie, and this was likely a complex mosaic of different prairie types (Robertson et al. 1997). Today, the only high quality prairies remaining in the IRBAA are 18.9 acres (7.6 hectares) of glacial drift hill prairies; however, there is 1.5 acre (0.6 hectare) of Grade C mesic black-soil extant at Mt. Palatine Cemetery Nature Preserve in Putnam County (Alesandrini 1991). While the Illinois River Section of the Illinois River and Mississippi River Sand Areas Division extends northward into the IRBAA, there is no evidence that the types of sand prairies found farther south (Gleason 1907, 1910) ever occurred the Assessment Area.

Common ecological problems associated with prairie, in general, include fragmentation, fire absence, exotic species invasions, and habitat destruction and degradation. Small, isolated fragments tend to support many species at low population levels (thus prone to local extinction) too distant to be enhanced through natural mechanisms of species dispersal. Isolated prairies also may be lacking appropriate pollinator species for successful sexual reproduction of many outcrossing species. The greater edge-to-volume ratios of small sites offer greater opportunities for exotic species invasions since the matrix areas typically are dominated by non-native vegetation. Highly fragmented and developed landscapes also lead to altered fire regimes often eliminating fire from prairie remnants until restoration efforts commence. Fire absence results in ecological changes such as encroachment of woody plants that can eliminate many prairie species. Fire absence can also lead to a severe invasion of exotic cool-season grasses like the ubiquitous species meadow fescue, smooth brome, and Kentucky bluegrass. Over-grazing by domestic stock typically degrades prairie remnants by eliminating many species and promoting the increase of several weedy native and non-native taxa (Nyboer 1981). Soil disturbances such as past efforts at cultivation result in loss of prairie species and

opportunities for the establishment of weedy taxa. All of these factors, and combinations of factors, tend to result in loss of species diversity and ecological integrity for all prairie community types. The water regimes of mesic, wet-mesic, and wet prairies have often been altered by the installation, sometimes long ago, of drainage tile and/or drainage ditches in adjacent areas.

Prairie

This natural community category includes the typical “black-soil” prairies. Soils are generally deep and fine-textured, usually silt loam or clay loam derived from loess and sometimes glacial till or alluvium. The soils have a well developed, dark (often black) A horizon. Soil moisture ranges from dry to wet; within the IRBAA the only high-quality extant prairies are mesic but undoubtedly, other types would have occurred.

Dry-mesic prairie – While not known to be extant in the IRBAA, dry-mesic prairies were undoubtedly once frequent. This habitat is typically found on slopes or on soil that is fairly well drained. The overall height of plants in late summer can exceed four feet, and the diversity of plant species is fairly high. Common grass species include little bluestem, big bluestem, prairie dropseed, prairie panic grass, switch grass, Indian grass, side-oats grama, and porcupine grass. Characteristic forbs include bird’s foot violet, black-eyed Susan, compass plant, cylindrical blazing star, downy gentian, drooping coneflower, bastard toadflax, flowering spurge, glaucous white lettuce, grass-leaved goldenrod, hoary puccoon, heath aster, New England aster, nodding lady’s tresses, Ohio spiderwort, pale coneflower, prairie cinquefoil, prairie coreopsis, prairie dock, Sullivant’s milkweed, prairie phlox, purple prairie clover, rattlesnake master, rigid goldenrod, rosinweed, rough blazing star, round-headed bush clover, shooting star, showy goldenrod, showy tick trefoil, sky-blue aster, smooth blue aster, western sunflower, horsetail milkweed, wild bergamot, common blue violet, and wild strawberry. Shrubs include leadplant, New Jersey tea, prairie willow, smooth sumac, and pasture rose.

Typical ecological problems in remnants include fire absence (and consequential woody plant encroachment) and exotic species invasion and establishment. Common exotic species include Kentucky bluegrass, Canada bluegrass, white and yellow sweet clovers, Queen Anne’s lace, parsnip, and asparagus (Solecki 1995, 1997).

Mesic prairie- Undegraded mesic tallgrass prairies are among the most species-rich plant communities per unit area (= species density) in North America. Typical remnants contain from 15 to 30 species in a half-meter-square sampling quadrat. About 100 to 130 taxa of vascular plants can be found in small (5 acre) remnants. Most of the species found in dry-mesic prairies also occur in mesic prairies, except for perhaps the following: bird’s foot violet, common blue violet, cylindrical blazing star, and side-oats grama. Additional species include Culver’s root, golden Alexanders, Indian paintbrush, prairie blazing star, purple meadow rue, prairie phlox, and white wild indigo. The dominant grass species are usually big bluestem, Indian grass, prairie dropseed, and switch grass. Some large forbs

include compass plant and prairie dock. The State Threatened Hill's thistle can occur in mesic prairies. Undoubtedly, mesic prairie was once abundant in the IRBAA, but today the only remnant is 1.5 acre (0.6 hectare) of Grade C at Mt. Palatine Cemetery Nature Preserve in Putnam County (Alesandrini (1991). Ecological problems are similar to those in dry-mesic prairies.

Wet-mesic prairie – This habitat is transitional between mesic and wet prairies and can include species that occur in each. Grass species include big bluestem, prairie cordgrass, switchgrass, blue joint grass, and Indian grass. Characteristic forbs include, closed gentian, Culver's root, golden Alexanders, grass-leaved goldenrod, marsh blazing star, monkey flower, New England aster, panicled aster, prairie dock, smooth phlox, purple meadow rue, Riddell's goldenrod, saw-toothed sunflower, Turk's cap lily, water hemlock, willow aster, winged loosestrife, and woundwort. Shrubs include pasture rose, swamp rose, prairie willow and sometimes pussy willow. No examples of this natural community are known to occur today in the IRBAA.

Wet prairie – In this community type, surface water is present during the winter and spring, and the soil is nearly always saturated. The diversity of plant species is less than in other prairie communities, with species listed above under wet-mesic prairie occasionally found in wet prairies. Grasses include blue joint grass, prairie cord grass, and big bluestem. Forbs include blue flag, common boneset, panicled aster, prairie Indian plantain, swamp saxifrage, water parsnip, winged loosestrife, woundwort. Shrubs include meadow sweet, swamp rose, prairie willow, and sometimes pussy willow. No remnants of this community type are known to be extant in the IRBAA.

Sand Prairie

Characteristic sand prairie vegetation occurs when the soil is composed predominantly of sand or sandy loam. White and Madany (1978) recognize five subcategories of sand prairie, based on soil moisture, from dry to wet. There is no current evidence that sand prairies occurred in the IRBAA, although there are extensive areas of sand prairie to the northwest of the area, beginning in Bureau County, and to the south in the Illinois River Section of the Illinois River and Mississippi River Sand Areas Division. See Gleason (1907, 1910) for detailed historical accounts of sand prairie along the Illinois and Mississippi rivers in Illinois.

Hill prairie

Hill prairies are grassland/forb communities that occur on slopes typically with exposure to the south and/or south-west and usually occur as openings in a forest rather than as part of a continuous prairie. In Illinois, hill prairies appear intermittently along most of the western border of the state formed by the Mississippi River and along the Illinois River from north of Peoria south to its junction with the Mississippi (Evers 1955, Bland and Kilburn 1966). A few hill prairies also occur in east-central Illinois and other scattered

localities. Soil moisture conditions are usually very dry on these well drained sites. For classification, hill prairies are distinguished not by soil moisture type but by substrate. Loess, glacial drift, gravel, and sand hill prairies are recognized in Illinois (White and Madany 1978); however, only glacial drift hill prairie is present in the IRBAA. Hill prairies often occur as islands of prairie vegetation surrounded by forest. The floristic composition of hill prairies is a combination of species that also occur in other prairie types (e.g., dry, black soil, sand, and gravel prairies) with only a few taxa largely restricted to hill prairies (Kilburn and Ford 1963, Robertson, Schwartz et al. 1995).

Because of their relative inaccessibility and typically steep slopes, hill prairies have rarely been cleared for crop production. Thus, a higher proportion of original hill prairie remains in Illinois than most other prairie types, leaving hill prairies as some of the last remnants of the prairie biome that dominated Illinois for 8,000 years prior to European settlement. Of the 446 hill prairies examined during field work for the Illinois Natural Areas Inventory only 127 sites were of high quality (Grades A and B), containing about 400 acres (White 1978, Nýboer 1981). Most of the remaining hill prairies are severely degraded as a result of grazing pressure (Nýboer 1981). It is thought that, under present climate conditions, hill prairies are readily invaded by trees in the absence of fire (Kilburn and Warren 1963, McClain 1983). While often degrading habitats, grazing may retard the process of woody invasion of hill prairies. The diminution of grazing in Illinois during the latter half of the 20th century, and lack of fire management, suggest that hill prairies may be lost to forests through secondary succession under current conditions. Indeed, reports have suggested that the remaining high quality sites are being lost at an alarming rate, (White 1978, Werner 1994). As these hill prairies disappear, so do the rich assemblages of plant species that relies on this unique habitat. In a study of hill prairies in Pere Marquette State Park in Jersey County, McClain (1983) compared aerial photographs of the area taken in 1937 and 1974 and calculated that 62% of the prairie area had been lost during that 37 year interval, largely due to the encroachment of native woody vegetation. Another study based on aerial photographs taken over a 50-year span was made of nine hill prairies in Illinois (Robertson and Schwartz 1994; Robertson, Schwartz et al. 1995; Schwartz et al. 1997). Medium- and large-sized hill prairies were reduced in size an average of 63.0%, while small hill prairies lost an average of 72.0% of their area.

Glacial drift hill prairie – This type of hill prairie occurs on eroded glacial drift, usually where a river valley cuts through an end moraine forming many deep, steep-sided ravines. In Illinois, glacial-drift hill prairies are found primarily along the Illinois River and tributaries from Tazewell to Putnam counties, with a few in Coles and Vermilion counties in east central Illinois. Within the IRBAA, these prairies occur on both the east and west sides of the Illinois River. This is rather unusual, as hill prairies form on steep southwest facing slopes, which generally are on the east side of rivers. However, in the IRBAA southwest facing slopes do occur on the west side of the Illinois River where ravines have a northwest to southeast orientation. Several of the hill prairies in the IRBAA were included by Evers (1955) in his detailed survey of hill prairies in Illinois.

Most were resurveyed by Evers in the early 1970s, and there unpublished data are in the natural areas files at the herbarium of the Illinois Natural History Survey.

Dominant grasses in this habitat include little bluestem, side-oats grama, and Indian grass. Other grasses frequently encountered include big bluestem, Canada wild rye, Kentucky bluegrass, porcupine grass, prairie dropseed, and rough dropseed. Herbaceous forbs on glacial drift hill prairies include aromatic aster, bastard toadflax, bird's-foot violet, butterfly weed, common blue-eyed grass, Culver's root, cylindric blazing star, drooping coneflower, false boneset, flowering spurge, fringed puccoon, golden Alexanders, green milkweed, hairy mountain mint, hoary vervain, leadplant, New Jersey tea, Ohio spiderwort, pale beardtongue, pale coneflower, pasture rose, prairie coreopsis, prairie phlox, prairie sunflower, purple prairie clover, rigid goldenrod, rough blazing star, round-headed bush clover, scurf pea, showy goldenrod, silky aster, sky-blue aster, small skullcap, stiff gentian, tall boneset, thimbleweed, western sunflower, white prairie clover, whorled milkweed, wild bergamot, wild petunia, yellow flax, and yellow star-grass.

Within the IRBAA, a number of glacial drift hill prairies are protected as Illinois Nature Preserves, and others are included on the Illinois Natural Areas Inventory (McFall 1980, 1982; McFall and Karnes 1995; Meyer 1983, 1987a, 1987b). There are a total of 7.5 acres (3.0 hectares) of Grade A and 11.4 acres (4.6 hectares) of Grade B glacial drift-hill prairie in the Assessment Area, which is 55.5% of the total high-quality proportion of this natural community in Illinois. The state endangered prairie dandelion and state threatened Hill's thistle occur on glacial-drift hill prairies in the IRBAA.

Savanna

Savanna habitats occur throughout many parts of the North America (McPherson 1997). The Midwest, intermediate between the eastern forests and grasslands of the great plains, has the environmental conditions and fire history that supported many savanna-like habitats (Anderson 1983, Bowles et al. 1994, DeLong and Hooper 1996, Nuzzo 1986, Taft 1997). Savannas are characterized by scattered, open-grown trees, with or without shrubs, and a continuous herbaceous ground cover typically dominated by graminoid species (grasses and sedges) and numerous forbs. Density and percent cover of trees varies and is intermediate between open prairie and closed woodland or forest. In this discussion, savannas are defined as having 1–50 mature trees per hectare or 10–50% canopy cover by trees (Bowles and McBride 1995); other figures are often used (see discussion in DeLong and Hooper 1996). In the dissected terrain of major river valleys, such as the Illinois River, savannas often occurred associated with a mixture of vegetation types including prairie, woodland-barrens, and forest (Zawacki and Hausfater 1969, Nelson et al. 1994). Midwestern savanna-like habitats have several unifying characteristics including: 1) open-canopied structure (relative to closed forest); 2) canopy dominance by a few species of oaks; 3) a ground cover usually rich in species associated with tallgrass prairie; 4) a majority of floristic diversity contained in the ground-cover; and 5) dependence on fire and other disturbances for maintenance of diversity and stability.

Oak-dominated systems particularly appear dependent on periodic fire for persistence (Lorimer 1985; Abrams 1992). In a period of a few decades of fire absence, savannas in the Midwest were altered through vegetational changes and habitat destruction. There was a rapid conversion of open savanna to closed woodland and forest. This is called the "Prairie-Forest Continuum" by Packard and Mutel (1997b). The following quote (Kline 1997) is pertinent when discussing the savanna and forest communities within the IRBAA. "The conspicuous trees of the savannas were the open-grown oaks, but another, less visible size class was well represented. The groves of large oaks were surrounded by and intermingled with large numbers of oaks of a different size class — multi-stemmed grubs, mostly white and black oak, that were annually top-killed by fire, but whose roots continued to increase in size. These were the nascent oak woodlands and oak forests of the future, awaiting a break in the fire regime that would release them and change that part of the mosaic from sparse to dense trees. The widespread cessation of fire accompanying settlement allowed large numbers of these grubs to grow into even-aged oak woods — the last instance of widespread oak forest regeneration to take place in the region...."

The once widespread oak savannas have become among the rarest plant communities (Curtis 1959, White 1978, Nelson 1987). Presently in the Midwest former savanna and open-woodland areas can still be recognized locally by the form and density of the oldest trees in closed woodland. Some small remnants persist where woody encroachment has been retarded (though not stopped) by droughty edaphic conditions. In addition, many savanna-like areas have been structurally maintained by livestock grazing, and in these instances the ground cover is floristically degraded and dominated by non-native species. The suppression of fire, fragmentation, habitat degradation, and non-native species are primary ecological problems associated with savanna habitats. Some problem non-native species found in savannas include common buckthorn, burdock, and garlic mustard.

Compared with other habitat types, relatively few threatened and endangered plant species appear to be dependent on savanna habitats (Taft 1997). Floristically, savannas contain species of both prairie and open woodlands, though many taxa appear to reach their greatest frequency in transitional (ecotonal) areas such as savannas. Several rare plant species are known from the region surrounding the IRBAA that may have occurred in savanna habitats in the Assessment Area. These include large ground plum (*Astragalus crassicaupus* var. *tricocalyx*), auriculate false foxglove (*Tomanthera auriculata*), pink milkwort (*Polygala incarnata*), blazing star (*Liatris scariosa* var. *niewlandii*), and buffalo clover (*Trifolium reflexum*). Populations of some of these taxa may be present but undetected in degraded savanna remnants in the IRBAA.

Three savanna subclasses are recognized in Illinois: *savanna* (generally on fine-textured soils), *sand savanna*, and *barrens* (local inclusions of a prairie flora within an otherwise forested landscape) (White and Madany 1978, Madany 1981); only the silt-loam savannas are known to occur in the IRBAA. Prior to European settlement, savanna was likely a frequent feature of the landscape in the IRBAA (Nuzzo 1986). Today, there are 4.0 acres (1.6 hectares) of undegraded savanna in the IRBAA. A few areas of former

savanna undoubtedly occur in the IRBAA that could be restored or at least rehabilitated with prompt vegetation management (see Apfelbaum and Haney 1991, Packard and Balaban 1994, Packard and Mutel 1997a). Due to limited floristic data, the descriptions of savanna composition for the IRBAA are based on characteristic species throughout the region of central and western Illinois and are generalized depictions of the (former) undegraded condition.

Dry-mesic savanna – In this natural community, the tree layer is comparable to dry-mesic upland forest while the understory layer is much the same as dry-mesic prairie. Dry-mesic savanna (including, for this discussion, dry-mesic barrens) occurred in the IRBAA on the upper slopes and ridge tops of areas dissected by the Illinois River and major tributaries. Dry-mesic savanna and dry-mesic barrens are somewhat synonymous terms to describe the open woodland/hill prairie complex that characterized the uplands bordering the major river valleys. These savannas were ecotonal between upland prairies and the upland forests found in more mesic and fire protected ravines bordering the major river valleys (Zawacki and Hausfater 1969) and probably contained many species of loess hill prairies. In the absence of fire, these areas rapidly developed into closed woodlands. Most areas of dry-mesic savanna/barrens have been destroyed, degraded, or have undergone vegetational changes. The following characterization is based on generalized descriptions provided by Zawacki and Hausfater (1969) for remnants along the Illinois River.

Characteristic tree species include white oak, and black oak. Occasional species include shingle oak, and bur oak, and hickories (shagbark, pignut). Species composition and density of the subcanopy are a condition of the recent fire history and may include many of the previous species in stages of recruitment. Shrubs include hazelnut (sometimes abundant), common blackberry, rough-leaved dogwood, leadplant, New Jersey tea, pasture rose, and prairie willow. Ground-cover species include a rich assortment of graminoid and forb species from prairie, savanna, and open woodland habitats. Important graminoid species (grasses and sedges) include big blue stem, poverty oat grass, white-haired panic grass, bottlebrush grass, little blue stem, Indian grass, and the sedges *Carex pensylvanica* and *C. artitecta*. Characteristic forb species include bird's foot violet, Canadian milk vetch, common carrion flower, Culver's root, hog peanut, pussy toes, pale Indian plantain, partridge pea, whorled milkweed, purple coneflower, shooting star, showy goldenrod, sky blue aster, slender mountain mint, starry catchfly, starry false Solomon's seal, tall coreopsis, wild hyacinth, wild quinine, wild strawberry, woodland sunflower, yellow pimpernel, and yellow star grass. Within the IRBAA, 4.0 acres (1.6 hectares) of Grade B dry-mesic savanna is still found. Because this is such a rare natural community today, these 4.0 acres represent 43.5% of all dry-mesic savanna known in Illinois (Table 8).

Mesic savanna – Mesic savannas typically were associated with prairie groves on level to slightly rolling terrain, at the base of moraine ridges, or as an island surrounded by wetland vegetation. Mesic savannas also may have occurred as ecotonal areas between upland prairie and bottomland forest along riparian corridors. Mesic savannas are particularly dependent on recurrent fire for maintenance. Without periodic fire, the soil-

moisture conditions allow rapid development of woody vegetation. Consequently, due to several factors (e.g., fire absence, habitat loss, and over-grazing) undegraded remnants, though formerly widespread, are among the rarest plant communities in the Midwest. Only 2.5 acres of degraded (Grade C) mesic savanna occurs in the IRBAA at Root Cemetery Nature Preserve in Peoria County. In all of Illinois, only 2.0 acres of undegraded (Category I) mesic savanna is known (Table 8).

In general, the compositional characteristics for mesic savannas is imprecisely known since so few remain. Typically, the most characteristic tree species of mesic savanna is bur oak; however, other species may be more important at individual sites including post oak, black oak, and white oak. Hickories (shagbark, pignut, sweet pignut) may be occasional at some sites. Shrubs are similar to dry-mesic savanna and include leadplant, New Jersey tea, gray dogwood, hazelnut, wafer ash, and prairie willow. Ground-cover species include several from mesic prairies. Among graminoid species, big blue stem, little blue stem, and Indian grass probably are abundant. Occasional grasses include poverty oat grass, Canada wild rye, Virginia wild rye, broad-leaved panic grass, and, in wet areas, prairie cord grass. Several sedges are common including *Carex brevior*, *C. meadii*, and *C. tetanica*.

At Root Cemetery, the only extant mesic savanna in the IRBAA, more than 100 plant species have been recorded (Solecki and Frye 1993). Tree species include shingle oak, black walnut, shagbark hickory, bur oak, and hackberry. These shrubs and woody vines are found: smooth sumac, hazelnut, wafer ash, bittersweet, New Jersey tea, and poison ivy. Herbaceous plants include a mix of woodland and prairie species, including: bastard toadflax, big bluestem, blue-eyed grass, common mountain mint, Culver's root, cup plant, false Solomon's seal, flowering spurge, French grass (a legume), green dragon, hoary tick trefoil, horsetail milkweed, Indian grass, Jacob's ladder, late horse gentian, little bluestem, Ohio spiderwort, pale Indian plantain, partridge pea, pasture rose, prairie cinquefoil, prairie parsley, red trillium, round-headed bush clover, showy tick trefoil, thimbleweed, Virginia bluebells, western sunflower, white trout lily, white wild indigo, wild bergamot, wild columbine, wild geranium, wild hyacinth, and wild strawberry.

Wet-mesic and wet savanna – About 56% of the floodplain of the lower Illinois River was forested in the early 1800s and, based on stem-density data calculated from Government Land Office (GLO) survey records, at least some of this forest could be inferred to have been wet to wet-mesic savanna (Nelson et al. 1994). While there are no documented occurrences of this natural community in the IRBAA, it probably did occur in the floodplain. Like wet and wet-mesic prairies of floodplains, bottomland savannas were probably maintained by a combination of factors including flooding and fire regime, topography, and soil moisture differences. Since no undegraded remnants are known from the IRBAA and no detailed descriptions are available, the following account is general and based, in part, on GLO data compiled by Nelson et al. (1994). Tree species probably included hackberry, pecan, American elm, cottonwood, pin oak, bur oak, black walnut, silver maple, river birch, and willows. Subcanopy and shrub layers probably were not well established but may have included box elder and elderberry. Characteristic ground-

cover species may have included prairie cord grass, Virginia wild rye, stout wood reed, giant ragweed, sawtooth sunflower, Jerusalem artichoke, and goldenglow.

Wetland

The wetland community class includes natural communities that are flooded or have hydric soils and that have a vegetative cover. There are about 33,205.93 acres (13,438.44 hectares) of wetland within the IRBAA, about 5.9% of the Assessment Area (Table 5). Wetland community types in the IRBAA, following natural community classification of White and Madany (1978), include floodplain forest, marsh, fen, sedge meadow, and seep & spring. Floodplain forests were described previously under the Forest community class. Wetlands in the IRBAA are scattered throughout the Assessment Area with concentrations along the Illinois River and its tributaries (Figure 10). About 77 acres of wetland (0.2% of the remaining wetland total) are recognized as high quality and undegraded natural communities among the natural communities of marsh, tall shrub fen, and seep (Table 8). Lakes and ponds are included in the next community class.

Marsh

Marshes are palustrine wetlands characterized by having water at or near the surface during most of the growing season, herbaceous vegetation predominates, and soils are peat, muck, or mineral (White and Madany 1978). In the marsh community subclass only one natural community, [typical] marsh, has been recognized within the IRBAA. Typical marshes occur in glacial pot-holes, in river valleys, and on lake plains. Marshes characteristically have distinct zones depending on water depth and plant species are distributed in predictable ways among these zones. In general, the deeper the water, the lower the plant species diversity. A total of about 2,276.5 acres (921.3 hectares) of emergent marsh vegetation, or 6.8% of the total current wetlands and 1.5% of the original amount, are reported for the IRBAA (Suloway and Hubbell 1994). The contemporary distribution of marsh in the basin is widespread.

Ecological problems in marshes include siltation, altered flooding regimes, invasion by non-native species, and over-abundance of aggressive, disturbance-tolerant native species. Siltation and altered flooding regime can reduce the integrity of a marsh. When changes in flooding dynamics result in increased frequency and/or duration of flooding, species intolerant to the new levels will decline and species tolerant of the new levels will increase. Species that increase under conditions of siltation and increased flooding include reed canary grass, common cattail, river bulrush, and common reed. Compared with upland habitats, relatively few exotics are wetland species (Havera and Suloway 1994). However, a few species, especially purple loosestrife and glossy buckthorn, are serious pests that can threaten the diversity of a wetland site. These aggressive species are still primarily found in the northern and, particularly, northeastern counties of Illinois, but could potentially extend their range southward along the Illinois River.

Characteristic plant species of marshes in the IRBAA include: arrow arum, bittersweet nightshade (introduced), blue flag, blue joint grass, blue vervain, brown fox sedge, common arrowleaf, common boneset, common bur-reed, common cattail, common horsetail, common reed, common water horehound, dark green bulrush, ditch stonecrop, fowl manna grass, great bulrush, halberd-leaved rose mallow, long-leaved ammania, marsh purslane, nodding beggar ticks, northern bugle weed, pale smartweed, creeping primrose willow, red-rooted spike rush, reed canary grass, rice cutgrass, river bulrush, river loosestrife, river sedge, sensitive fern, spotted Joe-Pye weed, straw-colored flat sedge, swamp aster, swamp dock, swamp goldenrod, swamp milkweed, sweet flag, tall water hemp, tufted loosestrife, water horsetail, water smartweed, and witch grass. Woody plants found in marshes include cottonwood, green ash, silver maple, American black currant, buttonbush, pale dogwood, peach-leaved willow, petioled willow, and red-osier dogwood. The federally and state threatened false decurrent aster occurs in some marshes in the floodplain of the Illinois River.

Fen

Bogs and fens are similar in that they are peatlands (peat accumulates when plant growth exceeds decomposition) and the peat at each community type typically is constantly saturated. In general, bogs are acidic, deficient in minerals, most nutrients come from rainfall and runoff, and the basin in which the bog occurs has limited drainage to the outside. Much of the upper horizon of peat in bogs is derived from sphagnum mosses while lower strata typically are composed of sedge peat. In contrast, fens usually are slightly to strongly calcareous, are constantly recharged with mineral-rich groundwater that has percolated through calcareous gravel in adjacent moraines, and most peat comes from sedges (Bowles et al. 1996, Johnson 1988, Moran 1981, Taft and Solecki 1990). Some fens occur within basins largely surrounded by moraines; typically, cool, calcareous, artesian ground water seeps up through the fen. Other fens form on level to slightly sloping areas where calcareous water seeps out of the bases of moraines. Floristically, these can resemble the seep natural community, however fens have considerable peat deposition.

Ecological problems associated with fens include grazing by domestic livestock, lowering of water table caused by ditching and other drainage activities, and fire suppression. Some management recommendations have been suggested (e.g., Natural Resource Management Staff 1996) regarding burning brush piles in fens. Non-native species are also a major problem today in fens in northeastern Illinois, especially purple loosestrife, glossy buckthorn, and common buckthorn.

Within Illinois, fens are most common in the upper Fox River basin; however, several fens also occur in the Illinois River Bluffs Assessment Area. Fens frequently occur near gravely moraines, and they are often associated with strongly calcareous seeps, sedge meadows, marl flats, and marshes. Dry gravel and dry-mesic gravel prairies sometimes can be found on kames and eskers adjacent to fen formations. There are five fen

communities in Illinois: calcareous floating mat, graminoid fen, low shrub fen, tall shrub fen, and forested fen. Only tall shrub fen occurs within the IRBAA.

Tall shrub fen — This is a very rare natural community in Illinois, found only in the IRBAA, and has sloping peat at the edge of a moraine with the dominant vegetation including tall shrubs as well as a mixture of seep and more typical fen plant species (Anonymous 1972, Natural Areas Section 1979). Sheviak (1974) called this natural community a “hanging fen.” The shrub species include red-osier dogwood, poison sumac, nannyberry, pussy willow, hoary willow, American black currant, and the native high-bush cranberry. Black ash is found on the edge of the fen. The herbaceous layer is composed of a number of shade and alkaline tolerant species: skunk cabbage, marsh marigold, lesser twayblade orchid, swamp saxifrage, spreading goldenrod, spring cress, Solomon’s seal, spotted phlox, blue flag, common water horehound, and spotted touch-me-not. At the base of the fen is a large marsh dominated by bulrushes and arrow arum.

The state endangered showy lady’s slipper orchid has been known from this locality for over 50 years, and the state threatened Queen-of-the-prairie also is found here. Also reported from the area are the small yellow lady’s slipper (*Cypripedium calceolus* var. *parviflorum*) and a rare hybrid (*Cypripedium* x *andrewsii*) between small yellow lady’s slipper and white lady’s slipper (*Cypripedium candidum*) (Anonymous 1972). A total of five acres of tall shrub fen occur within the IRBAA, representing all (100%) of the high-quality (Category I) tall shrub fen in Illinois (Table 8).

Sedge Meadow

Like bogs and fens, sedge meadows can occur on organic soils and sometimes include peat accumulation. The soil moisture is analogous to that of wet prairie. The diversity of plant species is generally low, and the structure and composition of this natural community is rather homogenous. The ecological integrity of most sedge meadows northeastern Illinois is threatened by invasive non-native plant species, especially purple loosestrife, and this species could move down the Illinois River to become a problem the IRBAA. Sedge meadows are also sensitive to lowering the level of groundwater, such as by ditching.

Within the IRBAA, two sedge meadows are known at one nature preserve in Bureau County (Anonymous 1979, Monoson and Schertz 1985). Elevated 3-10 feet (0.9-3 meters) above the floodplain on spring fed peat deposits, the sedge meadows have permanent springs and small seepages. Common plants are blue lobelia, cow parsnip, goldenglow, marsh marigold, monkey-flower, skunk cabbage, spotted Joe-Pye-weed, swamp goldenrod, spring cress, starry false Solomon’s seal, swamp aster, water dock, and white turtlehead. The dominant sedge in most sedge meadows is tussock sedge. Woody plants include American black currant, nannyberry, red-osier dogwood, and pussy willow. A large colony of the state threatened Queen-of-the prairie is scattered throughout the sedge meadow.

The exact acreage of sedge meadow in the IRBAA is not known. However, the area dedicated as nature preserve is 10.7 acres, and this includes sedge meadow, seep springs, and floodplain forest. These sedge meadows are not considered to be undegraded, but they are still significant.

Seep

Seeps are wetland communities characterized by a constant diffuse flow of ground water, typically from the lower portions of slopes of glacial moraines, ravines, and terraces (White and Madany 1978). The water chemistry of the ground water controls to some extent species composition and is influenced by the material it flows through. The Illinois Natural Areas Inventory (White 1978) identified about 30 high-quality seeps in the state. The majority of these seeps were in the Fox, Des Plaines, Illinois, and Vermilion river valleys. A total of 44 acres of high quality seeps occur today in the IRBAA, which represents 46.8% of all high quality seeps in Illinois.

In Illinois, five different seep community types are recognized: *seeps(typical)* are circumneutral and occur where the ground water is not strongly influenced by bedrock or parent material chemistry; *acid (gravel) seeps* occur associated with sandstone bedrock or gravel; *calcareous seeps* occur where the ground water is mineralized by alkaline bedrock (e.g., limestone) and/or soil parent materials like glacial drift; *sand seeps* emerge from sand deposits and may be calcareous, acid, or neutral; *spring communities* occur where a channel is formed. The seeps within the IRBAA mostly appear to be of the typical type, although at least one calcareous seep is reported.

Several endangered or threatened plants still occur or have been previously reported in seeps within the Assessment Area, including Queen-of-the-prairie, yellow monkey flower, alder buckthorn, forked aster, and marsh horsetail. The last three have been extirpated from the area.

Ecological problems associated with seeps include degradation by over-grazing and alterations to the watershed that influence ground water discharge. Non-native plant species that can be invasive are water cress and, in northeastern Illinois, purple loosestrife, which has been seen in the IRBAA but is not yet a problem.

Seeps (typical) – The typical seep has water that is nearly neutral in pH, or, as is mostly the case in the IRBAA, slightly calcareous; this water is usually cold. Seeps can be open (informally called graminoid seep) or wooded (informally called forested seep). Typical seep plants in the Assessment Area include: bottlebrush sedge, cinnamon willow herb, common cattail, cup plant, fowl manna grass, fringed loosestrife, goldenglow, leafcup, marsh marigold, prairie cord grass, skunk cabbage, spotted Joe-Pye weed, spotted touch-me-not, swamp goldenrod, swamp aster, swamp thistle, swamp wood betony, sweet scented bedstraw, and white turtlehead. Woody plants include red-osier dogwood, American black currant, and prairie rose.

Calcareous seep – This natural community is restricted in Illinois to the Wisconsin till plain. The groundwater in this natural community is strongly calcareous, and tufa deposits (concentration of calcium carbonate) may form, although this may not occur in the IRBAA. Calcareous seeps mostly are found at the bases of morainal systems and kames and eskers and often occur in association with fens. In typical seeps, peat does not form, however this distinction is not so clear with calcareous seeps. Many of the same plant species that occur in typical seeps and fens also occur in calcareous seeps.

Taft (1995a) described a small Grade C calcareous seep from Tazewell County. Some plants found in this area included: bottlebrush sedge, common boneset, common horsetail, common mountain mint, ditch stonecrop, grass-of-Parnassus, great angelica, great bulrush, marsh marigold, monkey flower, rough-leaf goldenrod, spotted Joe-Pye weed, spotted touch-me-not, swamp wood betony, water parsnip, white turtlehead, and whorled loosestrife.

Lake and Pond

Lakes and ponds are open-water habitats. Ponds are characterized as covering less than 20 acres.

Pond (natural) – Natural ponds are shallow-water wetlands that are not excavated or impounded. There are numerous ponds in the IRBAA mostly in the floodplains along the major streams and some may be connected so determining the exact number is somewhat arbitrary. No high-quality, undegraded natural ponds have been identified in the IRBAA. No descriptive data are available on the floristic composition of natural ponds in the IRBAA, although there are descriptions for natural lakes in the assessment area. See floristic composition for Lake (natural) for a general indication of plant species that can be found in natural ponds.

Lake (natural) – The Illinois River valley, prior to human-induced modifications of the watershed and floodplain with wetland drainage efforts and levees, was characterized by numerous back-water lakes, or sloughs, lateral to the river channel (Bellrose et al. 1983). No high-quality natural lakes have been identified within the IRBAA. There remain numerous lakes along the Illinois Rivers and many are interconnected lake/pond/slough complexes that change configuration depending on seasonal water levels. Total acreage of lacustrine wetlands in the IRBAA, including ponds, is about 15,534.3 acres (6,286.7 hectares). Floristic composition of lakes can be sorted into three categories: shore and mud flat species, emergent wetland species (grow in water most of season), and aquatics. Typical shore and mudflat species include giant ragweed, Spanish needles, nodding beggar ticks, purple stemmed tickseed, false nettle, American bindweed, buttonbush, water hemlock, nut grass, barnyard grass, common horsetail, creeping love grass, green ash, cottonwood, silver maple, honey locust, ditch stonecrop, fog fruit, Virginia knotweed, marsh yellow cress, peach-leaved willow, sandbar willow, black willow, brookweed, river bulrush, prairie cord grass, and cockle bur. Common to occasional

emergent wetland species include halberd-leaved rose mallow, marsh purslane, creeping primrose willow, American lotus, water smartweed, pickerelweed (usually rare), mild water pepper, cursed crowfoot, swamp dock, common arrowleaf, lizard's tail, and common bur-reed. Typical aquatic species include coontail, waterweed, slender and southern naiad, small duckweed, American water meal, and leafy, long-leaved, and comb pondweed.

Decurrent false aster, listed as federally and state threatened, may occur on the shores of back-water lakes of the Illinois River and can become locally abundant in disturbed wetland sites in the floodplain (Schwegman and Nyboer 1985, Phillippe and Larimore 1997, Taft 1994) and may occur undetected at additional sites within the assessment area. Ecological problems associated with natural lakes along the Illinois River have been addressed by Bellrose et al. (1983). In summary, drainage and levee districts formed in the early 1900s resulting in the drainage of about half of the lakes in the Illinois River valley. Removal of this area from flood pulses has resulted in greater flooding depths and increased sedimentation into the remaining lakes. Sedimentation rates have accelerated due to agricultural practices in the watershed of the Illinois River. Sedimentation rates, if unchecked, will eventually fill half of the remaining volume of many lakes within 200 years or less (Bellrose et al. 1983).

Primary

The Primary class includes a wide variety of natural communities that are associated with outcroppings of bedrock and in Illinois include glade and cliff communities (White and Madany 1978). These are absent from the IRBAA as bedrock is buried deep beneath glacially deposited materials.

Cultural Habitats

This class describes communities formed by human activities and disturbances and includes cropland, pastureland, successional fields, developed land, tree plantations, artificial lakes and ponds, and prairie reconstructions. This is the major community class in the IRBAA comprising about 62.3% of the total land area. These cultural areas impose some of the most challenging ecological problems for natural habitats in the IRBAA. Attempts to ameliorate the dramatic changes in the modern landscape are prairie reconstruction, termed prairie restoration by the INAI (White and Madany 1978), and efforts at wetland restoration. These are the only community types mentioned below (briefly) since they are the only examples in the Cultural community class of efforts to create natural communities.

Prairie Restoration - Typically, prairie reconstructions are plantings of prairie species on grassland soils where the original natural community has been destroyed. Prairie species are planted, sometimes in an effort to produce a warm-season grassland and sometimes with the goal of attempting to recreate the original prairie community. Prairie

reconstructions often are species poor and strongly dominated by a few species, often warm season grasses. The total area of prairie reconstruction is unknown from within the IRBAA. Very few prairie reconstructions have developed into communities that mimic undegraded tallgrass prairie in species richness or structure (Anderson 1972, McClain 1997, Packard and Mutel 1997a, and Schramm 1992).

Wetland Restoration - Wetland restorations attempt to create a stable ecosystem that is functionally and compositionally similar to natural wetlands (Admiraal et al. 1997). In the implementation of Section 404 of the Federal Clean Water Act of 1972, wetland restorations or *de novo* wetland creations are one of the mitigation measures that can be mandated when natural wetlands are destroyed or seriously degraded. The same situation applies under the Illinois Interagency Wetland Policy Act of 1989. Consequently, there are many wetland restorations underway in Illinois. However, many so-called wetland restorations are simplistic and do not have the species diversity and ecological complexity of natural wetlands.

Summary and Recommendations

The loss of natural habitat in the Illinois River Bluffs Assessment Area has been severe. Trends indicate that habitat losses and degradation for prairie and wetlands in the IRBAA appear to be about the same as rates for the state as a whole, while rates for forest and savanna are greater than statewide trends. Altogether, only 500.9 acres (202.7 hectares) remain in high quality, undegraded condition (about 0.09% of total area). This is only slightly more than statewide levels where 0.07% of total area of the state remains in a high-quality, undegraded condition. However, the whole IRBAA is of regional significance today as there are a relatively large number of extant remnants of natural communities that are otherwise rare or absent in the rest of Illinois, such as tall shrub fen, glacial drift hill prairies, seeps, and dry-mesic savanna. Concomitantly, there are also a number of State Endangered and Threatened plant species.

Despite the availability of a great deal of descriptive information regarding natural communities in the IRBAA, there remain many knowledge gaps, particularly the distribution, abundance, qualitative condition, and ecological trends among remnants. This is particularly true for silt-loam prairies, formerly the most abundant community class in the basin. Though floristic information is available for the few remnants, there is a lack of quantitative data. Furthermore, since remnants tend to have floristic differences (no two sites are the same), the fact that so little prairie remains suggests we have a poor representation of the original (presettlement) species diversity for the IRBAA. Particularly lacking are data on wet and mesic prairies, and the various savanna habitats, natural communities that formerly were common. Additional survey efforts in the IRBAA may identify new populations of threatened or endangered species and noteworthy remnants of natural communities.

Many of the most challenging conservation issues in the IRBAA are addressed primarily at the community and ecosystem levels. There are serious ecological problems that threaten the long-term maintenance of biodiversity in the IRBAA. Throughout the natural community descriptions for the IRBAA there are consistent references to a set of related ecological problems. These are habitat fragmentation, habitat degradation, exotic species invasion, and, for several community types, fire absence. The following five steps are recommended as an approach for gaining further insights of the natural communities in the IRBAA and developing a plan for the long-term maintenance of biodiversity.

1. Inventory

The results of the Illinois Natural Areas Inventory (INAI) provide data on the distribution and abundance of statewide-significant natural communities (White 1978). However, many natural communities occur in Illinois that, though they do not meet the qualitative standards of the INAI for undegraded and statewide-significant natural areas, contain regionally noteworthy and exceptional natural features. Many natural communities in the IRBAA, though somewhat degraded, retain relatively high levels of ecological integrity and have potential for further improvement through restoration efforts. Since the INAI sites are few and small in total area the somewhat degraded but restorable natural communities that remain are critical for the long-term maintenance of biodiversity in the region. Remnants among all community classes (e.g., forest, prairie, savanna, wetland, land and pond, and primary) need to be identified. For example, since no high-quality mesic prairie or floodplain forest habitats and little undegraded savanna remnants are known from the IRBAA, identification of the degraded remnants is central to any recovery effort for these community types. Floristic Quality Assessment, a method for evaluating the natural integrity of habitat remnants that employs numerous parameters of community characteristics (including floristic inventory data and INAI grades), is a promising technique for distinguishing remnants of native vegetation that have restoration potential (Taft et al. 1997).

2. Map

All results from natural community inventory efforts should be categorized and mapped to provide a spatial context for the locations of habitats with differing ecological condition. This will aid in identifying concentrations of noteworthy natural communities which can serve as focus areas. Trends in total area of each community class among qualitative units would serve as an aid in measuring success in restoration efforts (see below).

3. Protection

The natural communities with the greatest integrity need to be protected from further human induced degradation (e.g., damaging levels of grazing, off-road vehicle impacts,

soil grading in railroad rights-of-way). Inventory and mapping in the basin will aid in the prioritization of protection efforts. Highly isolated remnants pose distinct conservation and protection challenges compared with clusters of restorable natural communities. Staff of the Illinois Nature Preserves Commission (524 S. Second St., Springfield, IL 62701) are familiar with the various protection options and incentives for private landowners.

4. Identification and prioritization of ecological problems

As previously indicated, a host of related ecological problems consistently are present among remnant natural communities in the IRBAA (habitat fragmentation, habitat degradation, exotic species invasion, and fire absence). Some problems can be addressed more readily than others. *Habitat fragmentation* is a widespread problem with potentially devastating consequences for ecological integrity often resulting in an interruption of biological interactions, ecological processes, species migrations, and a reduction in habitat heterogeneity (Wilcove et al. 1986). A consequence, typically, is loss of species diversity. However, "solutions" to restoring biological connectivity and ecosystem-level process are extraordinarily complex and costly if the goal is to re-create corridors for all species among regional habitats. High levels of fragmentation may impose limits on maintaining or enhancing biodiversity in the long-term.

In contrast, *habitat degradation* is a widespread problem that can be slowed and/or minimized at many sites by removing the degradation factor (e.g., grazing, soil disturbances), although restoration to predisturbance condition in severe cases may require intensive vegetation management. It is difficult to find a private woodland in Illinois that does not bear indications of past cattle grazing. The effects of over-grazing can be persistent. Certain species (e.g., many ferns, orchids, trilliums, blue cohosh, bellflower, bloodroot, several grass and sedge species) appear to be sensitive to grazing disturbance and are often absent while certain grazing increasers (e.g., unpalatable species, thorn-bearing species, and plants with bristly fruits) are dominant. For instance, a typical situation in Illinois woodlands is a ground-cover and shrub flora dominated by common snakeroot, white snakeroot, buckbrush, Missouri gooseberry, blackberries (*Rubus* spp.), Virginia creeper, and the exotic garlic mustard. Usually, confounding influences such as grazing, increased shade, and siltation or other soil disturbances are involved.

Exotic species invasion can be considered both a species-level and a community-level problem. Some community-level management activities address more than one ecological problem. For example, garlic mustard invasion can be reversed with appropriately timed applications of fire (Nuzzo 1991; Schwartz and Heim 1996). Other serious exotic pests such as purple loosestrife require direct treatment or biological control (Thompson et al. 1987; Malecki et al. 1993). Exotic species known to pose severe ecological problems occur in the IRBAA. Recommended control measures are summarized in Table 13.

Table 13. List of selected invasive exotic species known or suspected to occur in the Illinois River Bluffs Assessment Area and recommended eradication methods.

Species	Cut & Apply Stump-Treatment Herbicide	Foliar Herbicide Application	Prescribed Fire	Cut &/or Hand Pull (get root)	Dig Root	Bio- Control	Cover w/ Black Plastic
Amur honeysuckle	X						
asparagus	X				X		
autumn olive	X						
black locust	X - Garlon 4						
Canadian bluegrass			X				
common buckthorn	X						
creeping Charlie		X	?	X			
cypress spurge*		?		X	X		
garlic mustard		X	X	X			
Kentucky bluegrass			X				
moneywort		X	?				
motherwort		?		X	X		
multiflora rose	X						
orange day lily		X			X		X
osage orange	X						
purple loosestrife		X		X		X	
Queen Anne's lace		X					
reed canary grass		X	X	X			
smooth brome grass		X					
tree-of-heaven	X			X			
white mulberry	X						
white sweet clover			X	X			
wild parsnip*		X		X	X*		
yarrow		X		X			
yellow sweet clover			X	X			

¹ The recommended herbicide, typically, is Round-up (glyphosate) except for black locust (Solecki 1997).

² Asterisk (*) indicates plant has phototoxic properties and should be avoided.

Fire is an ecological force that historically influenced many aspects of natural communities in the IRBAA. Many community types require fire for maintenance of community characteristics and diversity. Fire absence has resulted in changes in forest structure, composition, and diversity. Invasion of mesophytic species such as sugar maple into oak-hickory forests is a statewide phenomenon related to fire absence also occurring in central Illinois and the IRBAA. Many forests in Illinois are dominated in the canopy by oaks but have few oak saplings. Rather, shade-tolerant (and fire intolerant) species like sugar maple often are extraordinarily more common and dense than prior to settlement. An obvious consequence of this change is the possible loss of oak woodlands and the plant and wildlife species that depend on them. A rich assemblage of spring wildflowers can still be found in some woodlands because these spring ephemerals largely escape the ensuing shade of the dense overstory and thus selectively persist while typically only a

few shade-tolerant species can be found in the summer and fall. Also, the spring flora often has been spared direct effects of cattle grazing because livestock, typically, have been rotated historically to fescue pastures during spring months. Infrequent application of prescribed fire appear unlikely to reverse these trends. Rather, a long-term program of repeated applications of prescribed fire is often necessary before compositional stability is achieved. Nevertheless, prescribed fires can be implemented to a wide variety of remnants and community types, at little cost, and achieve measurable improvements in many parameters of ecosystem integrity (Schwartz and Hermann 1997).

5. Application of appropriate vegetation management

Once the ecological problems for a natural community are identified and prioritized according to restoration effort and gain, a program of vegetation management needs to be implemented. Record keeping is vital to tracking activities and levels of success in implementing each treatment plan. Floristic Quality Assessment (Taft et al. 1997) methods may provide a framework useful in measuring progress of each restoration activity.

Birds

Introduction

Information in this section is derived from standard references of Illinois, including the Illinois Natural Heritage Database (Illinois Department of Natural Resources 1997), The Illinois Breeding Bird Atlas (Kleen, in litt.), Avian Ecological Investigations (Illinois Department of Natural Resources, unpublished reports), and the results of extensive field work by personnel from the Illinois Natural History Survey (much of it ongoing and not yet published).

The Illinois River Bluffs Assessment Area (IRBAA) has a fairly typical bird species list for areas adjacent to the Illinois River in central Illinois. At least 275 of the 299 species that regularly occur in the state (exclusive of vagrants) can be found in the area (Table 14). Of these 275 species, 155 breed or formerly bred there (Table 14). Of these, 59 are either locally extinct, or are rare during the breeding season (species with a "r" in Table 14), which suggest that habitat loss has been a major problem in the region. Other species that are globally extinct (Passenger Pigeon, *Ectopistes migratorius* and Carolina Parakeet, *Conuropsis carolinensis*) formerly occurred in the basin, as did the locally extirpated Greater Prairie-Chicken (*Tyrannus cupido*), Ruffed Grouse (*Bonasa umbellus*) and Bewick's Wren (*Thryomanes bewickii*). In addition, there are many wetland species for which there is well substantiated historical breeding evidence, that are now absent or only occur as migrants (American Bittern, Trumpeter Swan, Lesser Scaup, Sandhill Crane, Whooping Crane (*Grus americana*), Black Tern, Marsh Wren, and Yellow-headed Blackbird). Although some could occur as breeding species again with habitat restoration and/or re-introduction, this clearly shows the extent of habitat loss in the region. On the other hand, there are a few locally extirpated species that have become reestablished in the region fairly recently including the Double-crested Cormorant, Bald Eagle and Wild Turkey.

Most forest patches away from the Illinois River are small and narrow and are unlikely to have successful breeding populations of most species (Brawn and Robinson 1996). However, a large area of forested land adjacent to the Illinois River known as the "Peoria Wilds" has considerable potential, as one of the larger tracts in the state for savanna/scrub/forest type bird associations, to become at least a local "source" area for some bird species in the region (i.e., more young are produced in the area than are needed to maintain the population). However, it may be a more important area for the restoration of wetland type habitats as there is already a fairly substantial area of public lands along the Illinois River, especially in Marshall Co., that historically had good populations of wetlands associated species. For this reason, along with ongoing savanna restoration in the Peoria Wilds, wetland habitats should be the primary focus of conservation efforts in the region, especially wetlands with adjacent upland grassland or forest habitats to buffer

them from surrounding agricultural and residential areas. We know little, however, about the effects of fragmentation on wetland habitats. The use by migratory birds of the forested corridor along the Illinois River is probably intense.

The bird species that live in the IRBAA are ecologically diverse and, although some species are able to live in a variety of habitats, many species occupy only one or a few habitats (Table 14). The sections following Table 14 describe the bird communities typically found in the major habitat types of the IRBAA, as well as the habitat-specific environmental problems and management solutions for bird communities in each habitat.

Table 14. Bird species that regularly occur in the Illinois Bluffs Assessment Area These are species that are likely to be present all or most years. This list excludes extinct species and the many wandering or "vagrant" species that have been recorded in the area. The purpose is to list only those species that have or could have significant populations in the area. The table also lists the habitats that are most likely to be occupied during each season.

Species ^{1,2}	Breeding ^{3,6,7}	Winter ^{4,6}	Migrant ^{5,6}
Common Loon <i>Gavia immer</i>			L
Pied-billed Grebe - ST <i>Podilymbus podiceps</i>	L W ^(r)		L W
Horned Grebe <i>Podiceps auritus</i>			L
American White Pelican <i>Pelecanus erythrorhynchos</i>			L
Double-crested Cormorant - ST <i>Phalacrocorax auritus</i>	W ^(r)		L
American Bittern - SE <i>Botaurus lentiginosus</i>	W ^(r)		W
Least Bittern - SE <i>Ixobrychus exilis</i>	W ^(r)		W
Great Blue Heron <i>Ardea herodias</i>	L W Fs F	L W	L W
Great Egret - ST <i>Ardea albus</i>	W ^(r)		L W
Snowy Egret - SE <i>Egretta thula</i>			W
Little Blue Heron - SE <i>Egretta caerulea</i>			L W
Cattle Egret <i>Bubulcus ibis</i>	W Fs ^(r)		C G W
Green Heron <i>Butorides virescens</i>	L W Fs		L W Fs
Black-crowned Night-Heron - SE <i>Nycticorax nycticorax</i>	L W Fs ^(r)		Fs W
Yellow-crowned Night-Heron - ST <i>Nycticorax violaceus</i>	W Fs ^(r)		Fs

Table 14. Continued

Species ^{1,2}	Breeding ^{3,6,7}	Winter ^{4,6}	Migrant ^{5,6}
Tundra Swan <i>Cygnus columbianus</i>			L W
Trumpeter Swan <i>Cygnus buccinator</i>			L W
Mute Swan <i>Cygnus olor</i>			L W
Greater White-fronted Goose <i>Anser albifrons</i>		L W	.L W
Snow Goose <i>Chen caerulescens</i>		L C	L W C
Canada Goose <i>Branta canadensis</i>	L W C	L W C R	L W C R
Wood Duck <i>Aix sponsa</i>	Fs W		Fs W L
Green-winged Teal <i>Anas crecca</i>	W ^(r)		W L
American Black Duck <i>Anas rubripes</i>			W L Fs C
Mallard <i>Anas platyrhynchos</i>	W C L Fs G	W C L Fs	W C L Fs
Northern Pintail <i>Anas acuta</i>	W ^(r)		W C L
Blue-winged Teal <i>Anas discors</i>	W G		W L
Northern Shoveler <i>Anas clypeata</i>	W ^(r)		W L
Gadwall <i>Anas strepera</i>			W L
American Wigeon <i>Anas americana</i>			W L
Canvasback <i>Aythya valisineria</i>			L W
Redhead <i>Aythya americana</i>			L W
Ring-necked Duck <i>Aythya collaris</i>	W ^(r)		L W
Greater Scaup <i>Aythya marila</i>			L W
Lesser Scaup <i>Aythya affinis</i>	W ^(r)		L W
Oldsquaw <i>Clangula hyemalis</i>			L
Surf Scoter <i>Melanitta perspicillata</i>			L

Table 14. Continued

Species ^{1,2}	Breeding ^{3,6,7}	Winter ^{4,6}	Migrant ^{5,6}
White-winged Scoter <i>Melanitta fusca</i>		L	L
Common Goldeneye <i>Bucephala clangula</i>		L	L
Bufflehead <i>Bucephala albeola</i>		L	L W
Hooded Merganser <i>Lophodytes cucullatus</i>	Fs ^(*)		L Fs W
Common Merganser <i>Mergus merganser</i>		L	L
Red-breasted Merganser <i>Mergus serrator</i>			L W
Ruddy Duck <i>Oxyura jamaicensis</i>			L W
Turkey Vulture <i>Cathartes aura</i>	F G C Fs Sav	F G C Fs Sav	F G C S Sav Fs
Osprey - SE <i>Pandion haliaetus</i>			L
Bald Eagle - SE, FT <i>Haliaeetus leucocephalus</i>	Fs L ^(*)	L	L
Northern Harrier - SE <i>Circus cyaneus</i>	G W ^(*)	G C W	G C W
Sharp-shinned Hawk - SE <i>Accipiter striatus</i>		F S R Fs Sav	F S R Fs Sav
Cooper's Hawk <i>Accipiter cooperii</i>	F S Sav	F S R Sav	F S R Sav
Northern Goshawk <i>Accipiter gentilis</i>		F S	F S W L
Red-shouldered Hawk - SE <i>Buteo lineatus</i>	Fs ^(*)	Fs	Fs
Broad-winged Hawk <i>Buteo platypterus</i>	F ^(*)		F
Swainson's Hawk - SE <i>Buteo swainsoni</i>	F G Sav ^(*)		F G Sav
Red-tailed Hawk <i>Buteo jamaicensis</i>	F C G R S	F C G R S	F C G R S
Rough-legged Hawk <i>Buteo lagopus</i>		C G	
Golden Eagle <i>Aquila chrysaetos</i>			F S G
American Kestrel <i>Falco sparverius</i>	R C G Sav	R C G Sav	R C G Sav
Merlin <i>Falco columbarius</i>			All

Table 14. Continued

Species ^{1,2}	Breeding ^{3,6,7}	Winter ^{4,6}	Migrant ^{5,6}
Peregrine Falcon - SE, FE <i>Falco peregrinus</i>			All
* Gray Partridge <i>Perdix perdix</i>	C G S	C G S	C G S
* Ring-necked Pheasant <i>Phasianus colchicus</i>	C G S	C G S	C G S
Wild Turkey <i>Meleagris gallopavo</i>	F S Sav Fs	F S Sav Fs C	F S Sav Fs C
Northern Bobwhite <i>Colinus virginianus</i>	S G C Sav	S G C Sav	S G C Sav
Yellow Rail - SE <i>Coturnicops noveboracensis</i>			G W
King Rail - ST <i>Rallus elegans</i>	G W ^(r)		G W
Virginia Rail <i>Rallus limicola</i>	W ^(r)		W G
Sora <i>Porzana carolina</i>	W ^(r)		W G
Common Moorhen - ST <i>Gallinula chloropus</i>	W ^(r)		W
American Coot <i>Fulica americana</i>	W ^(r)	L	W L
Sandhill Crane - SE <i>Grus canadensis</i>	W ^(r)		W G C
Black-bellied Plover <i>Pluvialis squatarola</i>			L W
American Golden-Plover <i>Pluvialis dominica</i>			W L C G
Semipalmated Plover <i>Charadrius semipalmatus</i>			W
Killdeer <i>Charadrius vociferus</i>	W R G C		W R G C
Greater Yellowlegs <i>Tringa melanoleuca</i>			W
Lesser Yellowlegs <i>Tringa flavipes</i>			W
Solitary Sandpiper <i>Tringa solitaria</i>			W
Willet <i>Catoptrophorus semipalmatus</i>			W
Spotted Sandpiper <i>Actitis macularia</i>	L		W
Upland Sandpiper - SE <i>Bartramia longicauda</i>	G ^(r)		G

Table 14. Continued

Species ^{1,2}	Breeding ^{3,6,7}	Winter ^{4,6}	Migrant ^{5,6}
Hudsonian Godwit			W
<i>Limosa haemastica</i>			
Ruddy Turnstone			W
<i>Arenaria interpres</i>			
Sanderling			W
<i>Calidris alba</i>			
Semipalmated Sandpiper			W
<i>Calidris pusilla</i>			
Western Sandpiper			W
<i>Calidris mauri</i>			
Least Sandpiper			W
<i>Calidris minutilla</i>			
White-rumped Sandpiper			W
<i>Calidris fuscicollis</i>			
Baird's Sandpiper			W G
<i>Calidris bairdii</i>			
Pectoral Sandpiper			C W G
<i>Calidris melanotos</i>			
Dunlin			W
<i>Calidris alpina</i>			
Stilt Sandpiper			W
<i>Calidris himantopus</i>			
Buff-breasted Sandpiper			W G
<i>Tryngites subruficollis</i>			
Short-billed Dowitcher			W
<i>Limnodromus griseus</i>			
Long-billed Dowitcher			W
<i>Limnodromus scolopaceus</i>			
Common Snipe	W ^(r)		W G
<i>Gallinago gallinago</i>			
American Woodcock	F Fs S		F Fs S
<i>Scolopax minor</i>			
Wilson's Phalarope - SE			L W
<i>Phalaropus tricolor</i>			
Red-necked Phalarope			L W
<i>Phalaropus lobatus</i>			
Franklin's Gull			L W C
<i>Larus pipixcan</i>			
Bonaparte's Gull			L W C
<i>Larus philadelphia</i>			
Ring-billed Gull	L W ^(r)	L W C	L W C
<i>Larus delawarensis</i>			
Herring Gull		L	W L C
<i>Larus argentatus</i>			

Table 14. Continued

Species ^{1,2}	Breeding ^{3,6,7}	Winter ^{4,6}	Migrant ^{5,6}
Thayer's Gull <i>Larus thayeri</i>		L	
Iceland Gull <i>Larus glaucoides</i>		L	
Lesser Black-backed Gull <i>Larus fuscus</i>		L	L
Glaucous Gull <i>Larus hyperboreus</i>		L	
Great Black-backed Gull <i>Larus marinus</i>		L	
Caspian Tern <i>Sterna caspia</i>			L
Common Tern - SE <i>Sterna hirundo</i>			L
Forster's Tern - SE <i>Sterna forsteri</i>			L W
Black Tern - SE <i>Chlidonias niger</i>	W ^(r)		L W
* Rock Dove <i>Columba livia</i>	R C	R C	R C
Mourning Dove <i>Zenaida macroura</i>	R C S	R C S	R C S
Black-billed Cuckoo <i>Coccyzus erythrophthalmus</i>	S		F S Sav
Yellow-billed Cuckoo <i>Coccyzus americanus</i>	F S Fs Sav		F S Fs Sav
Barn Owl - SE <i>Tyto alba</i>	C G R Sav ^(r)	C G Sav	C G Sav
Eastern Screech-Owl <i>Otus asio</i>	R S Sav	R S Sav	R S Sav
Great Horned Owl <i>Bubo virginianus</i>	F C R Fs Sav	F C R Fs Sav	F C R Fs Sav
Snowy Owl <i>Nyctea scandiaca</i>			C
Barred Owl <i>Strix varia</i>	F Fs	F Fs	F Fs
Long-eared Owl - SE <i>Asio otus</i>	F S ^(r)	F S	F S
Short-eared Owl - SE <i>Asio flammeus</i>		G	G
Northern Saw-whet Owl <i>Aegolius acadicus</i>		F S	F S
Common Nighthawk <i>Chordeiles minor</i>	R Sav		R G C

Table 14. Continued

Species ^{1,2}	Breeding ^{3,6,7}	Winter ^{4,6}	Migrant ^{5,6}
Whip-poor-will <i>Caprimulgus vociferus</i>	F Sav		F Sav
Chimney Swift <i>Chaetura pelagica</i>	R F S Fs Sav		All
Ruby-throated Hummingbird <i>Archilochus colubris</i>	F S R Fs Sav		F S R Fs Sav
Belted Kingfisher <i>Ceryle alcyon</i>	L W	L W	L W
Red-headed Woodpecker <i>Melanerpes erythrocephalus</i>	Fs R C	F Fs Sav	F Fs C R Sav
Red-bellied Woodpecker <i>Melanerpes carolinus</i>	F Fs S R Sav	F Fs S R Sav	F Fs S R Sav
Yellow-bellied Sapsucker <i>Sphyrapicus varius</i>	F Fs ^(r)	F Fs R Sav	F Fs R Sav
Downy Woodpecker <i>Picoides pubescens</i>	F Fs R S Sav	F Fs R S Sav	F Fs R S Sav
Hairy Woodpecker <i>Picoides villosus</i>	F Fs Sav R	F Fs R S Sav	F Fs R S Sav
Northern Flicker <i>Colaptes auratus</i>	S F R Sav Fs	S F R Sav Fs	S F R Sav Fs
Pileated Woodpecker <i>Dryocopus pileatus</i>	F Fs Sav ^(r)	F Fs Sav R	F Fs Sav R
Olive-sided Flycatcher <i>Contopus cooperi</i>			F Fs R S Sav
Eastern Wood-Pewee <i>Contopus virens</i>	F Fs R Sav		F Fs R Sav
Yellow-bellied Flycatcher <i>Empidonax flaviventris</i>			F S Fs
Acadian Flycatcher <i>Empidonax virescens</i>	F Fs		F Fs
Alder Flycatcher <i>Empidonax alnorum</i>			W S Sav
Willow Flycatcher <i>Empidonax traillii</i>	W S		W S Sav
Least Flycatcher <i>Empidonax minimus</i>	F Sav ^(r)		F S R Fs Sav
Eastern Phoebe <i>Sayornis phoebe</i>	R Fs		R Fs
Great Crested Flycatcher <i>Myiarchus crinitus</i>	F Fs Sav		F Fs S R Sav
Eastern Kingbird <i>Tyrannus tyrannus</i>	S G C Sav		S G A F C Sav
Horned Lark <i>Eremophila alpestris</i>	C G	C G	C G

Table 14. Continued

Species ^{1,2}	Breeding ^{3,6,7}	Winter ^{4,6}	Migrant ^{5,6}
Purple Martin <i>Progne subis</i>	L R W G		L W G
Tree Swallow <i>Tachycineta bicolor</i>	L W Fs G		L W Fs G
Northern Rough-winged Swallow <i>Stelgidopteryx serripennis</i>	L W Fs G		L W G
Bank Swallow <i>Riparia riparia</i>	L W G		L W G
Cliff Swallow <i>Petrochelidon pyrrhonota</i>	L W G ^(r)		L W G
Barn Swallow <i>Hirundo rustica</i>	C R W L G S		C R W L G S
Blue Jay <i>Cyanocitta cristata</i>	R F Fs S C Sav	R F Fs S C Sav	R F Fs S C Sav
American Crow <i>Corvus brachyrhynchos</i>	All	All	All
Black-capped Chickadee <i>Poecile atricapillus</i>	F S R Fs Sav	F S R Fs Sav	F S R Fs Sav
Tufted Titmouse <i>Baeolophus bicolor</i>	F R Fs Sav	F R Fs Sav	F R Fs Sav
Red-breasted Nuthatch <i>Sitta canadensis</i>		R	F R
White-breasted Nuthatch <i>Sitta carolinensis</i>	F R Fs Sav	F R Fs Sav	F R Fs Sav
Brown Creeper - ST <i>Certhia americana</i>	Fs ^(r)	F Fs R	F Fs R
Carolina Wren <i>Thryothorus ludovicianus</i>	R F Fs S Sav	R F Fs S Sav	R F Fs S Sav
House Wren <i>Troglodytes aedon</i>	R F S Sav		R F S Sav
Winter Wren <i>Troglodytes troglodytes</i>		F Fs W	F Fs W
Sedge Wren <i>Cistothorus platensis</i>	W G		W G
Marsh Wren <i>Cistothorus palustris</i>	W ^(r)		W
Golden-crowned Kinglet <i>Regulus satrapa</i>		F Fs R Sav	F Fs R Sav
Ruby-crowned Kinglet <i>Regulus calendula</i>			F S Sav
Blue-gray Gnatcatcher <i>Poliophtila caerulea</i>	F Fs S Sav		F Fs S Sav
Eastern Bluebird <i>Sialia sialis</i>	C G R S Sav	S F R C Sav	S F C G R Sav

Table 14. Continued

Species ^{1,2}	Breeding ^{3,6,7}	Winter ^{4,6}	Migrant ^{5,6}
Veery - ST	F Fs ^(r)		F Fs R Sav
<i>Catharus fuscescens</i>			
Gray-cheeked Thrush			F Fs R Sav
<i>Catharus minimus</i>			
Swainson's Thrush			F S R Fs Sav
<i>Catharus ustulatus</i>			
Hermit Thrush		S F R Fs Sav	S F R Fs Sav
<i>Catharus guttatus</i>			
Wood Thrush	F Fs		F R Fs Sav
<i>Hylocichla mustelina</i>			
American Robin	R S F Fs Sav	R S F Fs Sav	R S F Fs C G Sav
<i>Turdus migratorius</i>			
Gray Catbird	S Fs R Sav		S Fs R Sav
<i>Dumetella carolinensis</i>			
Northern Mockingbird	R S	R S	R S
<i>Mimus polyglottos</i>			
Brown Thrasher	S R C G Sav		S R C Sav
<i>Toxostoma rufum</i>			
American Pipit			C W
<i>Anthus rubescens</i>			
Cedar Waxwing	R S F Fs Sav	R S F Fs Sav	R S F Fs Sav
<i>Bombicilla cedrorum</i>			
Northern Shrike		G C S	
<i>Lanius excubitor</i>			
Loggerhead Shrike - ST	G S C ^(r)	G S C	G S C
<i>Lanius ludovicianus</i>			
* European Starling	R C F Fs Sav	R C F Fs Sav	R C F Fs Sav
<i>Sturnus vulgaris</i>			
White-eyed Vireo	S Fs Sav		S Fs Sav
<i>Vireo griseus</i>			
Bell's Vireo	S G		S G
<i>Vireo bellii</i>			
Blue-headed Vireo	F Sav ^(r)		F Fs Sav
<i>Vireo solitarius</i>			
Yellow-throated Vireo	F Fs		F Fs R
<i>Vireo flavifrons</i>			
Warbling Vireo	S R Fs Sav		S R F Fs Sav
<i>Vireo gilvus</i>			
Philadelphia Vireo			S F R Sav
<i>Vireo philadelphicus</i>			
Red-eyed Vireo	F Fs Sav		F Fs S R Sav
<i>Vireo olivaceus</i>			
Blue-winged Warbler	S ^(r)		S F R Sav Fs
<i>Vermivora pinus</i>			

Table 14. Continued

Species ^{1,2}	Breeding ^{3,6,7}	Winter ^{4,6}	Migrant ^{5,6}
Golden-winged Warbler <i>Vermivora chrysoptera</i>			F S Fs R Sav
Tennessee Warbler <i>Vermivora peregrina</i>			F R S Fs Sav
Orange-crowned Warbler <i>Vermivora celata</i>			S F R Sav Fs
Nashville Warbler <i>Vermivora ruficapilla</i>			S F R Sav Fs
Northern Parula <i>Parula americana</i>			F Fs R Sav
Yellow Warbler <i>Dendroica petechia</i>	S W		S W R Sav Fs
Chestnut-sided Warbler <i>Dendroica pensylvanica</i>	S ^(r)		S F Fs R Sav
Magnolia Warbler <i>Dendroica magnolia</i>			F S R Fs Sav
Cape May Warbler <i>Dendroica tigrina</i>			R F Fs Sav
Black-throated Blue Warbler <i>Dendroica caerulescens</i>			F R Fs Sav
Yellow-rumped Warbler <i>Dendroica coronata</i>		F Fs Sav	F S R Fs Sav
Black-throated Green Warbler <i>Dendroica virens</i>			F R Fs Sav
Blackburnian Warbler <i>Dendroica fusca</i>			F Fs R Sav
Yellow-throated Warbler <i>Dendroica dominica</i>	Fs ^(r)		F Fs
Pine Warbler <i>Dendroica pinus</i>			F Fs Sav R
Prairie Warbler <i>Dendroica discolor</i>	S ^(r)		S
Palm Warbler <i>Dendroica palmarum</i>			Fs S F R W G Sav C
Bay-breasted Warbler <i>Dendroica castanea</i>			F R Fs S Sav
Blackpoll Warbler <i>Dendroica striata</i>			F Fs R S Sav
Cerulean Warbler <i>Dendroica cerulea</i>	F Fs ^(r)		F Fs R Sav
Black-and-white Warbler <i>Mniotilta varia</i>	F ^(r)		F R Fs Sav S
American Redstart <i>Setophaga ruticilla</i>	Fs		F Fs S R Sav

Table 14. Continued

Species ^{1,2}	Breeding ^{3,6,7}	Winter ^{4,6}	Migrant ^{5,6}
Prothonotary Warbler <i>Protonotaria citrea</i>	Fs ^(r)		Fs
Worm-eating Warbler <i>Helmitheros vermivorus</i>	F ^(r)		F
Ovenbird <i>Seiurus aurocapillus</i>	F		F R S Sav
Northern Waterthrush <i>Seiurus noveboracensis</i>			Fs R
Louisiana Waterthrush <i>Seiurus motacilla</i>	F ^(r)		F Fs
Kentucky Warbler <i>Oporornis formosus</i>	F		F Sav Fs
Connecticut Warbler <i>Oporornis agilis</i>			S F Fs Sav R
Mourning Warbler <i>Oporornis philadelphia</i>			S F Fs Sav R
Common Yellowthroat <i>Geothlypis trichas</i>	G C W S R Sav		G C W S R Sav
Hooded Warbler <i>Wilsonia citrina</i>	F ^(r)		F R
Wilson's Warbler <i>Wilsonia pusilla</i>			S F Fs R Sav
Canada Warbler <i>Wilsonia canadensis</i>	F ^(r)		F Fs S R Sav
Yellow-breasted Chat <i>Icteria virens</i>	S		S Sav
Summer Tanager <i>Piranga rubra</i>	F Sav ^(r)		F Sav R
Scarlet Tanager <i>Piranga olivacea</i>	F Fs Sav		F Fs Sav R
Northern Cardinal <i>Cardinalis cardinalis</i>	R F Fs S C Sav	R F Fs S C Sav	R F Fs S C Sav
Rose-breasted Grosbeak <i>Pheucticus ludovicianus</i>	F Fs Sav S		F Fs R S Sav
Blue Grosbeak <i>Guiraca caerulea</i>	Sav S ^(r)		Sav S
Indigo Bunting <i>Passerina cyanea</i>	F Fs S Sav		F Fs S C Sav
Dickcissel <i>Spiza americana</i>	G C		G C
Eastern Towhee <i>Pipilo erythrophthalmus</i>	S F	S F	S F Fs R
American Tree Sparrow <i>Spizella arborea</i>		S G C R W Sav	S G C R W Sav
Chipping Sparrow <i>Spizella passerina</i>	R F Sav		R F Sav G S

Table 14. Continued

Species ^{1,2}	Breeding ^{3,6,7}	Winter ^{4,6}	Migrant ^{5,6}
Clay-colored Sparrow <i>Spizella pallida</i>			S
Field Sparrow <i>Spizella pusilla</i>	S G C Sav	S G W Sav	S G C W Sav
Vesper Sparrow <i>Pooecetes gramineus</i>	C G		C G
Lark Sparrow <i>Chondestes grammacus</i>	S C G		S C G
Savannah Sparrow <i>Passerculus sandwichensis</i>	G	G	G C W
Grasshopper Sparrow <i>Ammodramus savannarum</i>	G		G
Henslow's Sparrow - SE <i>Ammodramus henslowii</i>	G ^(r)		G
Le Conte's Sparrow <i>Ammodramus leconteii</i>			G W
Nelson's Sharp-tailed Sparrow <i>Ammodramus nelsoni</i>			W
Fox Sparrow <i>Passerella iliaca</i>		S Fs F	S Fs F R Sav
Song Sparrow <i>Melospiza melodia</i>	R S W C G	R S W C G	R S W C G
Lincoln's Sparrow <i>Melospiza lincolnii</i>			S W Fs R
Swamp Sparrow <i>Melospiza georgiana</i>	W ^(r)	W Fs S G	S W Fs G
White-throated Sparrow <i>Zonotrichia albicollis</i>		R S F Fs Sav	R S F Fs Sav
White-crowned Sparrow <i>Zonotrichia leucophrys</i>		S R G	S R G
Dark-eyed Junco <i>Junco hyemalis</i>		R S F Fs G Sav C	R S F Fs G Sav C
Lapland Longspur <i>Calcarius lapponicus</i>		C G	C G
Smith's Longspur <i>Calcarius pictus</i>			C G
Snow Bunting <i>Plectrophenax nivalis</i>		C G	
Bobolink <i>Dolichonyx oryzivorus</i>	G ^(r)		G W
Red-winged Blackbird <i>Agelaius phoeniceus</i>	W C R G S Sav	C G F Fs	W C R G S Sav
Eastern Meadowlark <i>Sturnella magna</i>	G C	G C	G C
Western Meadowlark <i>Sturnella neglecta</i>	G C ^(r)		G C

Table 14. Continued

Species ^{1,2}	Breeding ^{3,6,7}	Winter ^{4,6}	Migrant ^{5,6}
Yellow-headed Blackbird - SE <i>Xanthocephalus xanthocephalus</i>	W ^(r)		W
Rusty Blackbird <i>Euphagus carolinus</i>		C F F s	R C F s W
Brewer's Blackbird <i>Euphagus cyanocephalus</i>			C G
Common Grackle <i>Quiscalus quiscula</i>	R W F s F	C R F F s	R F F s C Sav
Brown-headed Cowbird <i>Molothrus ater</i>	All	C R F F s	All
Orchard Oriole <i>Icterus spurius</i>	S R W Sav		S R W F F s Sav
Baltimore Oriole <i>Icterus galbula</i>	R F F s S Sav		F F s R S Sav
Purple Finch <i>Carpodacus purpureus</i>		F F s R	F F s R S Sav
* House Finch <i>Carpodacus mexicanus</i>	R S	R S	F F s R S Sav
Red Crossbill <i>Loxia curvirostra</i>		F R	F R
White-winged Crossbill <i>Loxia leucoptera</i>		F R	F R
Common Redpoll <i>Carduelis flammea</i>		G S R F	
Pine Siskin <i>Carduelis pinus</i>	R S F ^(r)	R S F	R S F
American Goldfinch <i>Carduelis tristis</i>	S R G	S R G F F s Sav	S R G F F s Sav
Evening Grosbeak <i>Coccothraustes vespertinus</i>		R F F s	R F F s
* House Sparrow <i>Passer domesticus</i>	R C	R C	R C

¹ Bold type indicates: state threatened - ST, state endangered - SE, and/or federally endangered - FE.

² * designates an introduced species.

³ Breeding = species that currently or historically have bred in the area.

⁴ Winter = species present from December through February.

⁵ Migrant = species present during the March-May and late August-November periods.

⁶ The following habitat codes are used:

L = Lakes, ponds, impoundments, rivers, larger streams

C = Crops

G = Grassland (including pasture and hayfield)

W = Wetland (seasonally flooded, open habitats such as marshes and sedge meadows)

Fs = Forested swamp (forested wetland, including wet floodplain forest)

Sav = Savannah

F = Upland and mesic forest

R = Residential areas (including urban centers and the "urban forest")

S = Shrublands (open habitats dominated by shrubs, including old fields).

⁷ ^(r) designates a species that is currently a rare and local breeder and may be locally extirpated.

Some of these species are good candidates for reestablishment in restored habitats.

Forest

Most of the remaining forest habitat is found along the Illinois River and some of its smaller tributaries (Figure 9).

Regularly Occuring Species

Typical species - Typical breeding species of forest habitats in the IRBAA include Coopers Hawk (rare but increasing), Wild Turkey (successfully reintroduced), Yellow-billed Cuckoo, Great Horned Owl, Barred Owl, Red-headed Woodpecker, Red-bellied Woodpecker, Downy Woodpecker, Hairy Woodpecker, Northern Flicker, Eastern Wood-Pewee, Great Crested Flycatcher, Blue Jay, Black-capped Chickadee, Tufted Titmouse, White-breasted Nuthatch, Carolina Wren (population fluctuates depending upon winter weather), House Wren, Wood Thrush, American Robin, Yellow-throated Vireo, Red-eyed Vireo, Ovenbird, Scarlet Tanager, Northern Cardinal, Rose-breasted Grosbeak, Indigo Bunting, and Brown-headed Cowbird. Rarer forest species that also nest within the IRBAA include Broad-winged Hawk, Cerulean Warbler, Acadian Flycatcher, Least Flycatcher, Whip-poor-will, Blue-gray Gnatcatcher, and Ovenbird, Kentucky Warbler, Worm-eating Warbler (mostly a southern species), Louisiana Waterthrush (mostly a southern species), Hooded Warbler (mostly a southern species) and Baltimore Oriole (mostly in more open forests).

There are few stands of pine in this area. Pines are not native to the IRBAA, and pine plantations have unusual bird communities. In addition to more generalized forest species, pine plantations in central Illinois occasionally attract Long-eared Owls (SE) (mainly in winter), Northern Saw-whet Owls (mainly in winter), Solitary Vireos, Red Crossbills (very erratic), Pine Siskins, Yellow-bellied Sapsuckers, Golden-crowned Kinglets, Red-breasted Nuthatches, Yellow-throated Warblers, and Black-throated Green Warblers. Chipping Sparrows are often the most abundant species nesting in pine plantations. In winter, pines attract Northern Saw-whet Owls, winter finches (e.g., crossbills, Pine Siskin), Yellow-bellied Sapsuckers, and Red-breasted Nuthatches.

Threatened and endangered species - Several state threatened (ST) and endangered (SE) species may occur in forests in the area. Red-shouldered Hawks (SE) occasionally nest in the heavily forested bottomlands along the Illinois River. Brown Creepers (ST), occur in forested wetlands (see the following section on "Wetlands"), especially in the Marshall County Conservation Areas (Swan 1982). Veeries (ST) appear to occasionally nest in some woodlots in the area, especially in the Peoria Wilds area. The Long-eared Owl (SE) was formerly considered a "not uncommon breeder" in the area (Barnes 1912), but is apparently mostly an uncommon winter resident now.

Exotic species - European Starlings were introduced into the U.S. in 1890-1891 and spread to Illinois by 1922 (Bohlen and Zimmerman 1989). They are now one of the most abundant species in Illinois and may be detrimental to native species because they compete with residents for nesting cavities, especially in smaller woodlots.

Population Dynamics and Management

Many bird species are declining across part or all of their breeding range in the Midwest (Peterjohn et al. 1994). The causes of such changes are likely related partly to problems with reproduction in highly fragmented landscapes. The primary factors controlling productivity of birds in the IRBAA are predation on eggs or young in nests and brood parasitism by Brown-headed Cowbirds. Cowbirds lay their eggs in the nests of other species, and often destroy one of the hosts eggs when they lay their own. Cowbird young also grow faster than their host young and out-compete them for food, often leading to the starvation of the host young. Rates of nest predation and brood parasitism generally increase as a habitat becomes more fragmented, creating more feeding habitat for cowbirds and travel corridors for mammalian predators, such as raccoons, that often inhabit the edges of open country (Robinson et al. 1995). Given the relatively small size of most forest tracts, it is likely that levels of nest predation and brood parasitism by Brown-headed Cowbirds are extremely high (Robinson et al. 1995). In general, nest predation rates in Illinois forests of less than 500 acres average 70-90% and parasitism levels for cowbird hosts average 70-80%. These levels are so high that woodlots in this region are likely to be population sinks (Brawn and Robinson 1996) in which reproduction is far below rates necessary to sustain regional populations. Urban developments may increase abundance of some predators. Data from the Peoria Wilds suggest that levels of cowbird parasitism and nest predation are very high (J.D.Brawn, unpubl. data).

Remarkably, in spite of low productivity, many species nest commonly in regional woodlots and are not obviously declining. This strongly suggests that their populations are being rescued by the settlement of individuals from much larger forest tracts outside of the region, or even outside of the state (Brawn and Robinson 1996). Therefore, to understand the population dynamics of breeding forest birds, it is necessary to monitor both population size and nesting success. Previous research on this subject in Illinois (Robinson et al., in press) suggests that the best candidates for forest restoration are tracts that are, or can be 500 acres or larger. Few forests in the IRBAA are large enough to escape extreme levels of parasitism and predation, with the possible exception of the Peoria Wilds. As will be described below, savanna restoration may be the best strategy for many sites given the high value of oaks to migrant birds (Graber and Graber 1983) and the fact that most forest tracts are too small to have anything but maximal rates of nest predation and brood parasitism. The north-south orientation of the wooded Illinois River floodplain may lead to intensive use by migrating forest songbirds.

Wetland

Historically wetlands accounted for between 14% and 31% of the landcover of the individual counties in the IRBAA (mostly shallow lake and shallow marsh). Today however, wetland habitat has been reduced to between 0.6% and 4.6% of the landcover in the counties of the Assessment Area and 5.9% of the entire area. Despite this loss,

wetland habitats represent one of the most significant avian habitats in the Bluffs area, especially the Marshall and Woodford counties State Conservation Areas and provides valuable habitat for a rich assemblage of species.

Regularly Occurring Species

Typical species - In the wetland habitats of the IRBAA, typical wetland species include the Great Blue Heron, Great Egret (ST), Green Heron, Canada Goose, Wood Duck, Mallard, Killdeer, American Woodcock, Belted Kingfisher, Red-headed Woodpecker [forested], Northern Flicker [forested], Acadian Flycatcher [forested], Willow Flycatcher [shrubby], Purple Martin, Tree Swallow, Northern Rough-winged Swallow, Barn Swallow, Blue-gray Gnatcatcher [forested], Gray Catbird [shrubby], Warbling Vireo [forested], Yellow Warbler [shrubby], Cerulean Warbler [forested], American Redstart [forested], Common Yellowthroat, Song Sparrow, Swamp Sparrow, Red-winged Blackbird, Common Grackle, and Baltimore Oriole. Rarer species might include the Blue-winged Teal, Hooded Merganser [forested], Spotted Sandpiper, and Common Snipe.

Threatened and endangered species - Many federally threatened (FT), state threatened and state endangered species occur in the wetland habitats of the IRBAA. There are breeding records for Pied-billed Grebe (ST), Double-crested Cormorant (ST), Black-crowned Night-Heron (SE), Yellow-crowned Night-Heron (ST), American Bittern (SE), Least Bittern (SE), Great Egret (ST), Bald Eagle (SE, FT), Northern Harrier (SE), Red-shouldered Hawk (SE), King Rail (ST), Common Moorhen (ST), Sandhill Crane (SE), Black Tern (SE), Marsh Wren (ST), and Yellow-headed Blackbird (ST). Notable sites for these species include Marshall County State Conservation Area as well as numerous other marshes and forested bottomlands along the Illinois River. Protection of remaining wetlands, especially marshes, is an extremely high priority for this area.

Exotic species - The only non-native wetland species is the Cattle Egret, which is rare.

Population Dynamics and Management

Currently, the main problem for birds inhabiting wetlands is habitat loss and suburban encroachment. Some forested wetland species likely suffer from the same problems with fragmentation that affect forest species, such as cowbird parasitism and nest predation (Robinson and Hoover 1996). We know little, however, about the effects of fragmentation on other wetlands habitats. In fact, there have been no published studies of the population dynamics and nesting success of wetland birds in the region. Potentially, wetland species are more resistant to fragmentation, which may make this habitat a good target for conservation efforts in this landscape. Wetland habitats are also used heavily by migrating waterfowl, shorebirds, rails, and long-legged waders (herons, bitterns, and egrets). These habitats therefore have the potential to be important stopover sites for birds during migration. Wetland conservation should be the highest priority in the region for birds for reasons outlined above.

Savanna

Savanna habitats were once widespread in the Midwest. However, in recent decades as fire has become effectively suppressed, savanna habitats have been greatly altered through vegetative change. In addition to these changes, much of the savanna area has been lost to development and agriculture. As a result of these factors, savannas have become one of the rarest plant communities in the region (see section on "Savannas" in the Natural Vegetation Communities chapter of this report) but are actively being restored in several areas (e.g., Peoria Wilds).

Regularly Occurring Species

Typical species - Savannas share many species with forest habitats. Perhaps the most typical species of savannas would be: Whip-poor-will, Red-headed Woodpecker, Great Crested Flycatcher, Eastern Wood-Pewee, Blue Jay, House Wren, American Robin, Eastern Bluebird, Baltimore Oriole, Rose-breasted Grosbeak, Indigo Bunting, American Goldfinch, Field Sparrow, Chipping Sparrow and Summer Tanager. Other forest species remain common in savannas, including the Great Horned Owl, Northern Flicker, Red-bellied, Downy, and Hairy woodpeckers, Black-capped Chickadee, White-breasted Nuthatch, Brown-headed Cowbird, Scarlet Tanager, and Northern Cardinal. The open, park-like structure of some savannas also attracts some species that are more characteristic of grassland habitats, such as the Red-tailed Hawk and Northern Bobwhite. For many of these species, Illinois contains a significant portion of their global population.

Threatened and endangered species - None of the species inhabiting savannas in this area are threatened or endangered, although the Barn Owl (SE) may have been a bird of very open savannas. Swainson's Hawk (SE) formerly nested in the area, possibly when the area contained more open savanna habitat. Veeries (ST) sometimes nest locally.

Typical species - European Starlings are now one of the most abundant species in Illinois, and they are detrimental to native savanna species because they compete with resident birds (especially woodpeckers) for nesting cavities.

Population dynamics and Management

Savannas may be associated with high levels of cowbird abundance and parasitism levels, although some species may have higher nesting success in savanna restorations than in unburned forest (J.D. Brawn, unpubl. data). Many of the species that are most abundant in savannas are resistant to cowbirds (e.g., cavity nesters, American Robins, Baltimore Orioles). Unlike many forest birds, these species are able to recognize cowbird eggs and either eject them from their nests or rebuild the nests over them (Rothstein and Robinson 1994). A detailed study of the effects of savanna restoration on bird populations, ecology,

and nesting success is underway in adjacent watersheds (J.D. Brawn, unpubl. data). This study should be fully applicable to savannas in the IRBAA.

Savannas also appear to be very favorable habitat for migrants. The heavy use of oaks by spring migrants (Graber and Graber 1983) and by mast-consuming species suggests that savanna restoration should be a high priority for birds in this region.

Prairie/Grassland

Native prairie habitat is rare in the IRBAA (see the section on “Terrestrial Natural Communities”), however, many bird species that historically lived in prairies are also able to live in grassland habitat such as hay fields, and sometimes pastures. These habitats are also relatively uncommon in the IRBAA. There are only about 84,886 acres of grassland in the basin (15.1% of the land area). Although patches of available grassland habitat in the IRBAA are small, they have considerable potential for restoration and contain many typical grassland species. Pastures in the area are mostly heavily grazed and little-used by grassland birds. They are also favored sites for foraging Brown-headed Cowbirds which parasitizes the nests of many species.

Regularly Occuring Species

Typical species - In the IRBAA, typical species in prairie and grassland habitats include a subset of those found on larger grasslands throughout the state: Red-tailed Hawk, American Kestrel, Northern Bobwhite, Ring-necked Pheasant, Killdeer, Eastern Kingbird, Willow Flycatcher [shrubs], Horned Lark [recently burned], Barn Swallow, Brown Thrasher [shrubs], Sedge Wren, Bell’s Vireo [shrubs], Common Yellowthroat, Eastern and Western Meadowlarks, Red-winged Blackbird, Dickcissel, Lark Sparrow [sand areas], Savannah Sparrow, Song Sparrow, Grasshopper Sparrow, Vesper Sparrow, Field Sparrow, Bobolink, and American Goldfinch. See Table 14 for a more complete list of grassland species found in the Illinois River Bluffs region.

Threatened and endangered species - Currently, only three species of threatened or endangered species breed with any regularity in grasslands of the IRBAA and include the Upland Sandpiper (SE), Loggerhead Shrike (ST), and Henslow’s Sparrow (SE). However, the Northern Harrier (SE) and Barn Owl (SE) have been known to occasionally nest in the area. The Short-eared Owl (SE) can be found during migration and winter and may occasionally try to breed. The Greater Prairie Chicken was known to breed in the area as late as 1908 when 12 pairs and the last documented nest for the area were found (Barnes 1912).

Exotic species - Three introduced species are found in the grasslands of the IRBAA. The Ring-necked Pheasant, which is native to Asia, was first released in Illinois in about 1890 (Bohlen and Zimmerman 1989) and they continue to be released. The Gray Partridge, which is native to Europe and Asia, was first released in Illinois from 1906 through 1927

(Bohlen and Zimmerman 1989), and are near the southern edge of their breeding range in Illinois in this area. European Starlings feed in grasslands following grazing, mowing, or burning.

Population Dynamics and Management

Certain species, such as the Upland Sandpiper, Grasshopper Sparrow and Bobolink, have declined precipitously as grasslands have been converted to row crops (Herkert 1991). Currently, prairie remnants and other grassland habitats are probably too small to sustain regular breeding populations and successful nesting of most prairie species. For example, the Short-eared Owl is highly area-sensitive and will require larger grasslands than exist currently to maintain a regular breeding population. Large CRP (Conservation Reserve Program) fields attract small numbers of breeding Northern Harriers, Short-eared Owls, Henslow's Sparrows, Sedge Wrens, and Bobolinks. Records of Henslow's Sparrows are few ; this species is also area-sensitive and requires taller, ranker grass that has not recently been burned (Herkert 1994). King Rails (ST) and Northern Harriers (SE) would also be good candidates for re-establishment in restored grasslands. Upland Sandpipers (ST) occasionally nest in some areas, but they require mowing, grazing, or burning to keep the grass short. Upland Sandpipers are also area-sensitive and likely require larger grassland areas to maintain a continuous and thriving population in the area. Other rare or locally extirpated species that would be likely to increase rapidly if grasslands were restored include Barn Owl, Sedge Wren, Loggerhead Shrike (ST), and Bobolink. Because of the short supply of available grassland, prairie restoration and enhancement will be needed to attract grassland birds.

Removal of woody vegetation may also be beneficial. Shrubland species that would be lost are of little or no regional concern because they have large global populations and are common throughout Illinois (e.g., Gray Catbird, Brown Thrasher, House Wren). Perhaps the best way to maintain desired shrubland birds (Bell's Vireo, Willow Flycatcher, Yellow-breasted Chat) would be to allow willow thickets to grow in low, wet areas that would not burn in most areas. Natural hazel thickets may also have provided habitat for these species historically. The guidelines provided by Herkert et al. (1993) for grassland management should be followed. In particular, dense, tall stands of prairie grasses are rarely used by grassland birds and should be avoided.

Migrant and wintering birds use grasslands as stopover habitat, especially Smith's and Lapland Longspurs, Snow Buntings, LeConte's Sparrow, American and Sprague's Pipits, Loggerhead and Northern Shrikes, various rails, bitterns, American Golden Plovers, Pectoral and Buff-breasted Sandpipers, Short-eared and Snowy Owls, and Rough-legged Hawks.

Lakes, Ponds, Impoundments, Creeks, and Rivers

There are several natural lakes or ponds in the IRBAA (see section on “Aquatic Biota”), as well as a number of impoundments. Overall, open water accounts for 2.8% of the area (Table 4, Figure 11). Although the Illinois River has been highly altered by human activities, it still has many associated river species.

Regularly Occurring Species

Typical species - Double-crested Cormorants have begun to recolonize former breeding areas around the edges of some of the larger backwater lakes along the Illinois River and American White Pelicans are increasing as a non-breeding summer resident all along the Illinois River, especially near the larger backwater lakes, and may soon begin to nest as well. Peregrine Falcons (SE) and Northern Goshawks are found most often in areas along the Illinois River and it's larger backwater lakes as well as other large impoundments, where they hunt and harass the large aggregations of waterfowl that occur in these areas during migration and in the winter. Ospreys forage over lakes and ponds in migration. Belted Kingfishers forage and occasionally nest in steep banks along the edges of lakes and ponds. Spotted Sandpipers may occasionally breed around lakes, ponds, and impoundments. Common Grackles, Red-winged Blackbirds, Yellow Warblers, Common Yellowthroats and Song Sparrows nest along ponds, especially those with gradual shorelines and some emergent vegetation (e.g., *Typha*) along the edge. Eastern Phoebes, Barn Swallows, Purple Martins, and Tree Swallows forage over and along the edges of open-water habitats as long as nest sites are available and Cliff Swallows are particularly found nesting only where there are bridges, dams or other large man-made structures to attach their mud nests to. Green Herons often nest along ponds lined with dense, woody vegetation.

Among the species found along creeks and rivers are the following: Canada Goose, Mallard, Wood Duck [forested], Hooded Merganser [forested; rare], Coopers Hawk [forested corridors], Great Blue Heron, Great Egret, Black-crowned Night-Heron, Green Heron [forested], Osprey [migration], Killdeer, Great Horned Owl [forested], Barred Owl [forested], Belted Kingfisher, Eastern Phoebe [especially near bridges], Barn Swallow, Northern Rough-winged Swallow, Cliff Swallow [especially near bridges], House and Carolina Wrens [in woody debris], Cedar Waxwing, Warbling Vireo [woody corridors, especially cottonwoods and willows], Prothonotary Warbler (forested; uncommon), Yellow Warbler [shrubby corridors], Common Yellowthroat [grassy and shrubby streamsides], Common Grackle, Red-winged Blackbird, Baltimore Oriole [woody corridors], Indigo Bunting, Song Sparrow [shrubby steamsides].

Threatened and endangered species - The Bald Eagle (SE, FT) has winter roosts along the edges of backwater lakes and has also begun to nest in the area. There are several other threatened or endangered species that use the creeks and rivers of the area, with areas along the Illinois River being the most notable. These include the Double-crested

Cormorant (ST), Great Egret (ST), Black-crowned (SE) and Yellow-crowned (ST) Night-Herons, Bald Eagle (SE, FT), Red-shouldered Hawk (SE), and Brown Creeper (ST). Most of these birds are restricted to the larger tracts of forested riverbottoms along or adjacent to the Illinois River.

Exotic species - The Mute Swan is the only non-native species that would be likely to occur in the area. Although they are rare in Illinois, some may visit local ponds and could eventually establish a breeding population.

Population Dynamics and Restoration

One of the most important roles of lakes, ponds, and impoundments is as resting habitat for migrating waterbirds. These open-water habitats are often the only deepwater habitat available for loons, grebes, scaup, Common Goldeneyes, Buffleheads, and mergansers, all of which dive to catch food. Similarly, gulls and terns often forage over open water during migration. At low water, the edges of lakes are also used by shorebirds, herons, and egrets. All species of swallows use open-water for foraging, especially during cold weather.

A comparative study of the use of various ponds, lakes, and impoundment by migrating birds might help improve their design and management, but probably the most useful way to enhance these habitats is by increasing the amount of emergent vegetation along their edges. This essentially involves creating shallow wetlands along the edges of open water. Also, colonies of waterbirds nesting along the edges of lakes should be protected from disturbances. Nesting platforms could attract Double-crested Cormorants and Ospreys.

We lack data on populations and nesting success of birds in riparian corridors of varying widths and of their use by migrants. It would also be interesting to measure the movements of migrants along corridors to determine if they act as flyways. Much concern has been raised recently over the effects of barge and other river traffic on the Illinois River as well as general habitat deterioration and diminishment of the flood-pulse. There are currently several multi-million dollar habitat rehabilitation projects underway along the Illinois River. Most aspects of these projects are designed to keep sediment-laden water out of floodplain impoundments as much as possible (Illinois Department of Energy and Natural Resources 1994). This strategy will probably improve areas for some waterfowl, waders and shorebirds, but it is not as clear how replacing the natural floodpulse of the river will affect other avian communities along the river, especially marsh dependent birds and other passerine species. However, increasing the amount of woody riparian corridor habitat should enhance populations of many species, and would help restore natural hydrology. Restoring the hydrology would, in turn, improve wetland habitat in the floodplain, both in woody backwaters and in oxbows.

Cultural Habitats: Cropland

Agricultural areas generally provide poor habitat for most birds — plant diversity in cropland is much lower than in the original habitats. However, it is still important to consider the role of agricultural habitats for supporting bird populations. In the IRBAA, 59.7% of the land has been usurped for crop production (Table 4, Figure 6).

Regularly Occurring Species

Typical species - Cropland bird communities in the IRBAA have about the same bird species that are common statewide in this structurally simple habitat: Mallard, Red-tailed Hawk, American Kestrel, Ring-necked Pheasant, Killdeer, Rock Dove, Mourning Dove, Great Horned Owl, Eastern Phoebe [farmsteads], Horned Lark, Barn Swallow, American Crow, Eastern Bluebird (where nest boxes are provided), Loggerhead Shrike (ST), European Starlings, House Sparrow, Common Grackle, Brown-headed Cowbird, Red-winged Blackbird, Dickcissel (grassy strips and fallow cropland), Vesper Sparrow, Grasshopper Sparrow (grassy strips and fallow cropland) and Field Sparrow. Some species characteristic of recently burned and heavily grazed, dry grasslands have adapted to croplands, including the Horned Lark, Vesper and Savanna Sparrows. Intensively farmed areas offer little in the way of stopover habitat except around farmsteads and wet fields in the spring for gulls, shorebirds and longspurs.

Threatened and endangered species - The Loggerhead Shrike (ST) has adapted to croplands. However, it also requires spiny hedgerows for nesting and is now rare in the area.

Exotic species - Introduced species thrive in the agricultural habitats of the IRBAA. In fact, four of the most common species in the cropland of the IRBAA, Ring-necked Pheasant, Rock Dove, European Starling and House Sparrow, were all introduced from Europe or Asia. Gray Partridge, another introduced species from Europe and Asia, is also found in small numbers in the area.

Population Dynamics and Management

Warner (1994) documented the low populations and extremely low nesting success of birds in Ford County, an area of very intensive agriculture. On the other hand, increasing grassy cover along roadsides, drainage ditches, and around farmsteads can substantially increase grassland bird habitat. Within an agricultural landscape, the CRP can also benefit cropland birds by providing nesting cover and attracting such species as Dickcissels, and Henslow's, Grasshopper, and Savannah Sparrows.

Cultural Habitats: Successional Fields

Successional habitats, such as abandoned fields and pastures, are relatively uncommon in the IRBAA. These habitats, which are often dominated by non-native species of shrubs and vines, may be structurally similar to native successional habitats that historically occurred along the edges of meandering rivers or in large treefall gaps. Such habitats usually have dense, protective cover and are often rich in fruit producing plants, and therefore offer rich habitat for breeding and migrating birds. However, given the scarcity of natural shrublands in the Midwest, we know little about natural shrublands. Nonetheless, many local species that use shrubby vegetation now depend almost entirely on anthropogenic disturbances to set back succession.

Regularly Occurring Species

Typical species - Successional habitats dominated by forbs, shrubs, and saplings offer a rich habitat for many breeding birds. Typical species include Northern Bobwhite, Gray Partridge, Ring-necked Pheasant, American Woodcock (wet areas), Mourning Dove, Black-billed Cuckoo, Ruby-throated Hummingbird, Northern Flicker, Downy Woodpecker, Eastern Kingbird, Willow Flycatcher [wet thickets], Blue Jay, Black-capped Chickadee, House Wren, Carolina Wren, Gray Catbird, Brown Thrasher, Northern Mockingbird (uncommon), American Robin, Eastern Bluebird, Cedar Waxwing, Bell's Vireo, White-eyed Vireo, Blue-winged Warbler (uncommon), Yellow Warbler, Common Yellowthroat, Yellow-breasted Chat, Red-winged Blackbird, Northern Cardinal, Rose-breasted Grosbeak [older thickets], Blue Grosbeak (rare this far north), Indigo Bunting, House Finch, American Goldfinch, Eastern Towhee, Field Sparrow, and Song Sparrow. Successional habitats add greatly to local diversity, although only a few of these species have nationally declining populations (Yellow-breasted Chat, Field Sparrow, Blue-winged Warbler).

Threatened and endangered species - The only threatened species dependent on shrublands in the IRBAA is the Loggerhead Shrike (ST).

Exotic species - Most species found in successional habitats are native, although Ring-necked Pheasants and Gray Partridges both use early successional fields, and House Finches breed in shrubbery.

Population Dynamics and Management

Although nest predation rates appear to be very high in successional habitats, brood parasitism levels are generally moderate or low (Robinson et al., in press). This may be true because some species nesting in these habitats eject cowbird eggs (Gray Catbird, Brown Thrasher, Cedar Waxwing, Eastern Kingbird, Baltimore Oriole, American Robin), nest in cavities that are inaccessible to cowbirds (both Wrens, Chickadees, Eastern Bluebird), abandon many parasitized nests (Yellow Warbler, Field and Chipping

Sparrows), defend their nests aggressively (Red-winged Blackbird, Eastern Kingbird, Willow Flycatcher, Common Grackle), have inappropriate diets for cowbird nestlings (House Finch, American Goldfinch), or continue nesting until very late in the season when cowbirds have stopped laying (Mourning Dove, Yellow-billed Cuckoo, Gray Catbird, Cedar Waxwing, White-eyed Vireo, Northern Cardinal, Indigo Bunting, American Goldfinch, and Eastern Towhee). As a result, early successional species may be able to thrive even in small patches in agricultural landscapes. An intensive study of habitat requirements, nesting success, and population dynamics of shrubland birds is now underway (S.K. Robinson, J.D. Brawn, and E.J. Heske, unpubl. data). The results of this study should be applicable to shrubland birds in the IRBAA. Shrubland species may be excellent target species for lands managed to promote game species, especially Northern Bobwhites.

In addition to use during the breeding season, shrublands are very heavily used by migrating species, especially in habitats mingled with scattered trees. Shrubland-preferring migrants include, the Long-eared Owl, Northern Saw-whet Owl [mainly in evergreens], Yellow-bellied Flycatcher, Alder Flycatcher, Least Flycatcher, Philadelphia Vireo, Golden-winged Warbler, Orange-crowned Warbler, Chestnut-sided Warbler, Mourning Warbler, Connecticut Warbler, Wilson's Warbler, Canada Warbler, and Lincoln's Sparrow. Shrubland habitats therefore provide real benefits to migrant birds and greatly increase local biodiversity.

Cultural Habitats: Developed Land

Residential and urban areas, found especially around Peoria, represent 2.6% of the IRBAA. (Table 4, Figure 7). These areas, scattered with lawns, parks, and other manicured vegetation, offer suitable breeding habitat for relatively few bird species.

Regularly Occurring Species

Typical species - Typical breeding species include: Red-tailed Hawk [in more sparsely inhabited areas], American Kestrel [especially farmsteads], Killdeer, Rock Dove, Mourning Dove, Eastern Screech-owl, Great Horned Owl, Common Nighthawk, Chimney Swift, Ruby-throated Hummingbird, Northern Flicker, Red-bellied and Downy Woodpeckers [urban forests], Eastern Wood-Pewee, Eastern Phoebe, Barn Swallow, Purple Martin, Blue Jay, American Crow, Black-capped Chickadee, Tufted Titmouse, White-breasted Nuthatch, House Wren, Carolina Wren, Gray Catbird, Brown Thrasher, Northern Mockingbird (especially around farmsteads), American Robin, Eastern Bluebird [farmsteads], European Starling, Warbling Vireo, Common Yellowthroat, House Sparrow, Common Grackle, Brown-headed Cowbird, Baltimore Oriole, Northern Cardinal, House Finch, American Goldfinch, Chipping Sparrow, and Song Sparrow.

Developed lands contain an unusual mix of species that can use ornamental shrubs (e.g., Northern Cardinal and Song Sparrow), shade trees (e.g., Baltimore Oriole, Warbling

Vireo, Black-capped Chickadee, Tufted Titmouse, Eastern Wood-Pewee), pine plantings (e.g. Pine Siskins), short mowed grass (e.g., American Robin, Common Grackle, Northern Flicker, American Crow, Brown-headed Cowbird, Mourning and Rock Doves, European Starling, and Chipping Sparrow), and can nest safely in human structures (e.g. Wood Duck [chimneys] American Kestrel, Killdeer [roofs, roads], Common Nighthawk [roofs], Chimney Swift, Eastern Phoebe, Barn Swallow, Purple Martin, House and Carolina Wrens, American Robin, Eastern Bluebird, European Starling, House Sparrow and House Finch). This community has no parallel in the natural world.

Threatened and endangered species - There are no threatened or endangered species found in residential or urban areas other than the Loggerhead Shrike, which often forages in the mowed grass of rural farmsteads. Barn Owls were formerly a common breeding species in this habitat but have been mostly extirpated in the area as well as most of the rest of the state.

Exotic species - Many species in developed areas are introduced. Huge populations of European Starlings, House Sparrows, Rock Doves, and House Finches compete with native species for nest sites and food at bird feeders. House Finches are native to the western United States but after a population was released on Long Island in the 1940s, they spread west from New York and are now common in the urban and rural areas of Illinois.

Population Dynamics and Mangement

Developed areas are characterized by abnormally high population densities of species that occasionally or regularly depredate nests (e.g., Blue Jay, American Crow, House Wren, Gray Catbird, Common Grackle, and Brown-headed Cowbird). Bird feeders further augment populations of many species in rural or urban areas, especially the House Finch, by increasing winter survival.

Nesting success of species of developed areas has not been systematically studied. Such studies could lead to recommendations for enhancing populations of the native species that have adapted to human developments. However, high populations of predatory birds, domestic cats, and other mammalian predators may make it difficult for many species that build open-cup nests in accessible locations to nest successfully.

Although not well suited to support many naive breeding birds, developed land, such as tree-lined residential area, can be very important for migrating landbirds. These species make heavy use of shade trees in developed areas and, when available, also use shrubs. Typical migrants of urban forests include Cooper's and Sharp-shinned Hawks [both forage at bird feeders], Common Nighthawk, Ruby-throated Hummingbird [especially at feeders], Northern Flicker, Yellow-bellied Sapsucker, Red-breasted Nuthatch [conifers], Brown Creeper, Hermit Thrush, Golden-crowned Kinglet, Ruby-crowned Kinglet, Cedar Waxwing, Red-eyed Vireo, Tennessee Warbler, Cape May Warbler [conifers], Black-

throated Green Warbler, Blackburnian Warbler, Bay-breasted Warbler, Blackpoll Warbler, American Redstart, Rusty Blackbird, Evening Grosbeak [feeders], Purple Finch [feeders], Pine Siskin [feeders, conifers], American Goldfinch [feeders], Eastern Towhee [feeders], Dark-eyed Junco [feeders], American Tree Sparrow, White-crowned Sparrow, and White-throated Sparrow.

Management Recommendations

For breeding birds, we recommend the following strategies for improving habitats:

Forests - The IRBAA contains a substantial area of both upland and bottomland forest (including restored savanna areas) as well as several rich wetland bird communities and a major migration corridor. Conservation efforts should therefore be concentrated in these larger forested areas. Most forest sites in the IRBAA away from the Illinois River valley and its tributaries are small and have little potential to be enlarged sufficiently to create tracts large enough to avoid extremely high levels of nest predation and brood parasitism. For these areas, restoration of native plant communities, especially savanna, coupled with judicious consideration of the needs of migrant birds (some shrubby areas and oak trees) might be the best management strategy.

Wetlands - Wetland conservation should clearly be of the highest priority in the IRBAA because of relatively large populations of many state threatened and endangered species that rely on this habitat. Wooded and grassland buffer strips around wetlands can provide habitat for declining grassland birds, help buffer wetlands from surrounding development, and provide nesting habitat for many wetland species. This coordinated management of wetland habitats, especially large wetlands, or complexes of nearby smaller wetlands, offers the best hope for sustaining populations of endangered and threatened species.

Grasslands - Where possible, grasslands should be at least 100 acres, should be burned or mowed on a schedule that leaves some areas unmanaged for at least three years, and should contain small wetlands. Woody vegetation should be kept to a minimum.

Shrublands - These habitats are valuable to birds and should be managed simultaneously for game and nongame species.

Developed and agricultural areas - Developed areas, especially urban forest and parks, can be managed to improve habitat by encouraging oaks and leaving shrubby areas for migrants. Agricultural areas benefit from increased cover provided by CRP fields, shrub-lined drainage ditches, and unmowed roadsides. Any plantings that add cover and nest sites should be encouraged, especially to provide habitat during the nonbreeding season.

Mammals

Introduction

Information in this section has been compiled primarily from range maps and known records in Hoffmeister (1989) and the Illinois Natural Heritage Database (Illinois Department of Natural Resources 1997). Taxonomy follows Wilson and Reeder (1993). The Illinois River Bluffs Assessment Area (IRBAA) has not been thoroughly surveyed for many species of mammals. There are no records from the IRBAA for many widespread species (Hoffmeister 1989), particularly small mammals such as insectivores and bats, although the area is included in their geographic ranges.

Mammal species known or likely to occur in the IRBAA are listed in Table 15. The 47 species in this table represent 78% of the approximately 60 mammal species that currently occur in Illinois (Hoffmeister 1989). The population status of these species in the IRBAA is unknown therefore designations in Table 15 are projections based on their status in other parts of Illinois. Of the nine mammal species listed as threatened and endangered in Illinois (Illinois Endangered Species Protection Board 1994), only the bobcat, *Felis rufus*, has been recorded within the IRBAA (Illinois Department of Natural Resources 1997). Three threatened or endangered species (bobcat, river otter, Indiana bat) have been reported outside of the assessment area boundary but within the area displayed on maps in this report. Because of the significance of these species, and because they could occasionally occur in the IRBAA, they are included in the species list.

Forest

Typical Species

Mammal species known or likely to occur in the IRBAA that are restricted to forested habitats include the hoary bat, eastern chipmunk, gray and fox squirrels, southern flying squirrel, woodland vole, gray fox, and bobcat. Species that are primarily associated with forested habitats but also occur in other habitats include the red bat, white-footed mouse, and raccoon. Other species of bats use forested habitats extensively, although many roost under bridges or in buildings. Some species, such as the eastern cottontail, woodchuck, and white-tailed deer, require wooded habitat at certain times of the year or specialize in the use of forest edges. Additional habitat generalists typically found in forests in the IRBAA are listed in Table 15.

Table 15. List of mammal species known or likely to occur in the Illinois Bluffs Assessment Area¹.

Common name ²	Order Scientific Name	Habitat ³	Population status ^{4,5}
Marsupials	Didelphimorphia		
Virginia opossum	<i>Didelphis virginiana</i>	W, G, F	C
Insectivores	Insectivora		
masked shrew	<i>Sorex cinereus</i>	W, G, F (mesic)	C?
northern short-tailed shrew	<i>Blarina brevicauda</i>	W, G, F	C
least shrew	<i>Cryptotis parva</i>	G	U?
eastern mole	<i>Scalopus aquaticus</i>	G, F	C
Bats	Chiroptera		
little brown bat	<i>Myotis lucifugus</i>	F, caves, buildings	C
Indiana bat (FE/SE)	<i>Myotis sodalis</i>	F, caves	R?
northern long-eared bat	<i>Myotis septentrionalis</i>	F, caves, buildings	C
silver-haired bat	<i>Lasionycteris noctivagans</i>	F, caves (hibernation)	U?
eastern pipistrelle	<i>Pipistrellus subflavus</i>	F, caves, buildings	C
big brown bat	<i>Eptesicus fuscus</i>	F, caves, buildings	C
red bat	<i>Lasiurus borealis</i>	F	C
hoary bat	<i>Lasiurus cinereus</i>	F	U?
evening bat	<i>Nycticeius humeralis</i>	F, buildings	U?
Rabbits	Lagomorpha		
eastern cottontail	<i>Sylvilagus floridanus</i>	G, F	C
Rodents	Rodentia		
eastern chipmunk	<i>Tamias striatus</i>	F	C
woodchuck	<i>Marmota monax</i>	G, F (edges)	C
thirteen-lined ground squirrel	<i>Spermophilus tridecemlineatus</i>	G	C
Franklin's ground squirrel	<i>Spermophilus franklinii</i>	G	U?
gray squirrel	<i>Sciurus carolinensis</i>	F, urban	C
fox squirrel	<i>Sciurus niger</i>	F	C
southern flying squirrel	<i>Glaucomys volans</i>	F	C
plains pocket gopher	<i>Geomys bursarius</i>	G	C
beaver	<i>Castor canadensis</i>	W	C
western harvest mouse	<i>Reithrodontomys megalotis</i>	G	C?
deer mouse	<i>Peromyscus maniculatus</i>	G	C
white-footed mouse	<i>Peromyscus leucopus</i>	W, G, F (mostly F)	C
meadow vole	<i>Microtus pennsylvanicus</i>	G	C
prairie vole	<i>Microtus ochrogaster</i>	G	C
woodland vole	<i>Microtus pinetorum</i>	F	U?
southern bog lemming	<i>Synaptomys cooperi</i>	W, G	U?
muskrat	<i>Ondatra zibethicus</i>	W	C
Norway rat *	<i>Rattus norvegicus</i>	buildings	C
house mouse *	<i>Mus musculus</i>	G, buildings	C
meadow jumping mouse	<i>Zapus hudsonius</i>	W, G, F	U?
Carnivores	Carnivora		
coyote	<i>Canis latrans</i>	W, G, F	C
red fox	<i>Vulpes vulpes</i>	W, G, F	C
gray fox	<i>Urocyon cinereoargenteus</i>	F	U?
raccoon	<i>Procyon lotor</i>	W, G, F	C

Table 15. Continued

Common name ²	Species name	Habitat ³	Population status ^{4,5}
least weasel	<i>Mustela nivalis</i>	G	U?
long-tailed weasel	<i>Mustela frenata</i>	W, G, F	C
mink	<i>Mustela vison</i>	W, G (mostly W)	C
badger	<i>Taxidea taxus</i>	G	U
striped skunk	<i>Mephitis mephitis</i>	W, G, F	C
river otter (SE)	<i>Lontra canadensis</i>	W	R?
bobcat (ST)	<i>Felis rufus</i>	F	R
Even-toed ungulates	Artiodactyla		
white-tailed deer	<i>Odocoileus virginianus</i>	W, G, F	C

¹ Compiled from range maps and known records reported in Hoffmeister (1989) and Illinois Department of Natural Resources (1997).

² Bold type indicates a federally endangered (FE), an Illinois endangered (SE), or an Illinois threatened (ST) species. * = exotic species.

³ Habitats: W = wetland, G = grassland, F = forest.

⁴ Population status: C = common, U = uncommon, R = rare, ? = status uncertain.

⁵ Subjective estimate based on personal experience of E. J. Heske and J. E. Hofmann in Illinois.

Most species of mammals associated with forests are not restricted to one type of forest (i.e., upland or floodplain) but use a variety of forest types seasonally or opportunistically. However, species that hibernate (woodchucks, eastern chipmunks) or are primarily fossorial (woodland voles) need well-drained, unflooded soils. Fox squirrels are more strongly associated with upland forests, but gray squirrels can be abundant in both upland and floodplain forests. Gray squirrels require extensive tracts of forest, whereas fox squirrels can occupy open forests, woodlots, and fencerows (Hoffmeister 1989). Gray squirrels, however, also occur in many urban areas, including some in the IRBAA (e.g., Peoria; Nixon et al. 1978). Tree squirrels, flying squirrels, and chipmunks tend to be most abundant in forests with a heavy component of mast-producing trees such as oaks and hickories. Gray fox are most abundant in upland forests, but also may be abundant in bottomland forests (Hoffmeister 1989). Raccoons are most abundant in forest tracts with proximity to water (Hoffmeister 1989).

Threatened and Endangered Species

A bobcat was reported in Singing Woods, 4 miles north of Peoria, in 1994 (Illinois Department of Natural Resources 1997). No other records of threatened or endangered mammal species associated with forests have been reported for the IRBAA. A bobcat also was sighted in the Pecumsaugan Creek/Blackball Mines Nature Preserve in LaSalle County in 1993, east of the IRBAA (Illinois Department of Natural Resources 1997). This nature preserve is also the home of a large colony of Indiana bats (Illinois Department of Natural Resources 1997), and it is possible that Indiana bats could occasionally occur in forested areas of the IRBAA.

Habitat Requirements and Distribution of Listed Forest-dwelling Species

Bobcat - Optimal habitat for bobcats in the Midwest would be rough or rolling terrain where large tracts of second-growth forest with dense underbrush are interspersed with open areas (e.g., clearings or successional fields), streams, and rock outcrops (Schwartz and Schwartz 1981, McCord and Cardoza 1982). Bobcats also inhabit floodplain forests along major rivers and swamps (Hoffmeister 1989). Rollings (1945) thought that key factors in bobcat habitat selection were prey abundance, protection from severe weather, the presence of suitable den sites, dense cover, and a lack of human disturbance. Small caves, rock crevices, rock piles, logs, stumps, hollow trees, dense thickets, and brush piles are used as resting sites and natal dens (Jackson 1961, Schwartz and Schwartz 1981, McCord and Cardoza 1982). Bobcats change resting sites frequently, except for females with young who occupy dens in inaccessible areas. Bobcats travel extensively while hunting and require large tracts of suitable habitat (Rollings 1945, McCord and Cardoza 1982). Male bobcats in Missouri have annual home ranges of 46 to 72 km² and females have ranges covering 13 to 31 km² (Schwartz and Schwartz 1981). Rhea (1982) identified areas greater than 259 km² with more than 50% forest cover and good interspersed open areas, streams, and rocky terrain as optimal habitat for viable breeding populations of bobcats. According to these criteria, the best potential breeding habitat in Illinois is located in the Shawnee Hills region, along the lower Illinois River, and in the northwestern corner of the state. There are recent records of bobcats for 24 counties, most of which are in southern and northwestern Illinois (Illinois Department of Natural Resources 1997).

Indiana bat - Indiana bats congregate in a limited number of caves or mines for hibernation, but are more widely dispersed during the summer. Indiana bat maternity colonies roost primarily beneath slabs of exfoliating bark on dead trees, but have also been found beneath the shaggy bark of certain live hickories and in tree cavities (Cope et al. 1974, Humphrey et al. 1977, Gardner et al. 1991, Callahan 1993, Kurta et al. 1993a,b). Males and non-reproductive females may also roost in caves or abandoned mines. Roost trees used by this species have been located in both upland and floodplain forests; most are relatively large (>22 cm dbh). Tree species that have been used by maternity colonies in Illinois are slippery elm, northern red oak, shagbark hickory, silver maple, cottonwood, post oak, bitternut hickory, white oak, American elm, sycamore, and green ash (Gardner et al. 1991, Gardner and Hofmann, unpublished data, Kurta et al. 1993a,b). Indiana bats forage in and along the canopy of both riparian and upland forests (Humphrey et al. 1977, LaVal et al. 1977, Brack 1983, Clark et al. 1987, Gardner et al. 1991). There are recent summer records of Indiana bats in 23 counties in central and southern Illinois (Gardner et al. 1996, Illinois Department of Natural Resources 1997).

Exotic Species

The Norway rat and house mouse are the only known exotic mammals in the area. The Norway rat, in particular, is strongly associated with human structures. Both species may

be found in woodlots in proximity to human structures, but neither is generally considered a forest species. These species are now so widespread that they are part of the mammalian fauna throughout the United States. Not much can be done to rectify this situation and it is not one for concern. Domesticated animals such as house pets frequently cause problems for wildlife. Feral and outdoor cats (*Felis silvestris*), in particular, can have severe negative impacts on native songbirds and small mammals (Warner 1985, Coleman and temple 1996).

Information Gaps

Data on the population status of several forest-dwelling species are not available. Additional information on the distribution and abundance of the Indiana bat, silver-haired bat, hoary bat, evening bat, woodland vole, and gray fox would be valuable. Determining whether the remaining forest tracts can support resident bobcat or serve primarily as a dispersal route for transient individuals would help guide management decisions for this species.

Enhancement and Restoration Potential

Protecting both upland and floodplain forested tracts and maintaining dispersal corridors such as the forested riparian zone along the Illinois River could enhance the suitability of the IRBAA as habitat for gray fox and bobcat. Only about 16.3% of the IRBAA is forested, and much of this area is concentrated along the river and its tributaries. Managing the remaining forests to maintain large snags with exfoliating bark or cavities would provide roosting habitat for forest-dwelling bats, including Indiana bats, and den sites for other mammals such as the southern flying squirrel.

Wetland

Typical Species

Mammal species occurring in the IRBAA whose life history requires wetland habitats include the beaver, muskrat, and mink. In addition, all species of bats found in the IRBAA would use wetland areas, primarily as foraging habitat. The masked shrew, northern short-tailed shrew, and meadow jumping mouse use wetlands extensively in addition to mesic forests or grasslands. Other habitat generalists that use wetlands are listed in Table 15. Because the same subset of mammal species found in the IRBAA is likely to be associated with lakes, ponds, impoundments, creeks, and rivers as well as marshes, this section should serve as a report on mammals in mesic habitats in general. Small mammals such as the northern short-tailed shrew and meadow jumping mouse may be found in mesic areas without standing water, whereas the larger mammals such as the beaver and muskrat require open water (still or moving) habitats. Sightings of river otters in areas north and east of the IRBAA suggest that this species will eventually be reported

in the IRBAA as well, especially if recent introductions of river otters to other watersheds around Illinois result in successful establishment of breeding populations.

Threatened and Endangered Species

There are no reports for the IRBAA of any threatened or endangered species associated with wetlands. The state-endangered river otter has, however, been reported within a few miles north and east of the IRBAA (Illinois Department of Natural Resources 1997). The Illinois River and its tributaries in the IRBAA should be able to support river otters, especially in the northern parts of the watershed away from the urbanized areas around Peoria.

Habitat Requirements and Distributions of Listed and Rare Wetland Species

River otters occupy a variety of aquatic habitats, from coastal swamps and marshes to high mountain lakes (Toweill and Tabor 1982). They are abundant in estuaries, the lower reaches of rivers, and the tributaries and lakes of unpolluted river systems, but scarce in densely populated areas, especially if the water is polluted (Toweill and Tabor 1982). In Illinois, river otters have been found in shallow lakes, sloughs, cypress swamps, rivers, streams, drainage ditches, and ponds (Anderson 1982, Anderson and Woolf 1984). Habitat used by river otters in northwestern Illinois has the following characteristics: isolation from the main river channel (providing a relatively stable water level), extensive riparian forest (or emergent herbaceous vegetation), the persistence of open water during winter, good water quality (and healthy fish populations), the presence of suitable den sites (e.g. beaver lodges, log piles, exposed tree roots), and minimal human disturbance (Anderson and Woolf 1984). The shape of river otter home ranges is determined by the type of habitat and their size is influenced by prey abundance, topography, weather conditions, and the individual's reproductive status (Melquist and Hornocker 1983). At the Lamine River Wildlife Area in Missouri otter home ranges were 11-78 km in length (Erickson et al. 1984). Only a portion of the range is used at any time; activity centers are located in areas with abundant food and suitable shelter and are changed frequently (Melquist and Hornocker 1983). River otters may travel long distances, 160 km or more, in search of suitable habitat (Jackson 1961). Recent river otter records exist for 35 Illinois counties (Illinois Department of Natural Resources 1997). The main breeding populations of river otters inhabit the backwaters and tributaries of the Mississippi River in Jo Daviess, Carroll, Whiteside, and Rock Island counties in northwestern Illinois (Anderson 1995). Smaller populations also occur in the Cache and Big Muddy river systems of southern Illinois and the numbers of reports along the Rock River and the middle portion of the Mississippi River have been increasing (Anderson 1995).

Exotics

House mice occasionally can be found in wetland habitats. This species is so widespread that it is now part of the mammalian fauna throughout the United States. There is not much that can be done to alter this situation and it is not one for concern. Free ranging and feral house cats also can sometimes have severe impacts on native songbirds and small mammals, and they may occasionally forage in or around wetlands.

Information Gaps

Many wetlands, especially emergent wetlands, currently exist as isolated habitat patches. The ability of wetland-associated mammals to disperse between such wetlands should be examined. Surveys to determine the distribution and status of masked shrews, southern bog lemmings, and mink should be conducted. Beaver have been increasing in abundance throughout the state. The status of beaver populations in the IRBAA and their impact on the physical structure of riparian systems should be evaluated.

Enhancement and Restoration Potential

The preservation (and, if necessary, restoration) of riparian forest along the Illinois River and associated drainages could attract river otters to the IRBAA, especially if introductions to other areas produce potential immigrants. Reduction of silt and chemical runoff into wetland habitats also will improve their ability to attract and support river otters.

Grassland

Typical Species

Mammal species likely to occur in the IRBAA that are restricted to grassland include the least shrew, thirteen-lined and Franklin's ground squirrels, western harvest mouse, deer mouse, meadow vole, prairie vole, least weasel, and badger. Other species strongly associated with grasslands include the masked shrew, northern short-tailed shrew, eastern cottontail, woodchuck, southern bog lemming, and meadow jumping mouse. Additional species that use grasslands include the habitat generalists listed in Table 15.

Most grassland species of mammals are not restricted to native or undisturbed grassland habitat. Rather, the structure of rights-of-way, small grain fields, agricultural field edges, pastures, old fields, prairie restorations, and similar constructed or disturbed sites provides suitable habitat for many of these species. Thirteen-lined ground squirrels are most abundant in short grasses, whereas Franklin's ground squirrels are found in grasses of intermediate height (Hoffmeister 1989). Both species prefer areas that provide an unobstructed view; thus, tall grasses are inhabited rarely. The masked shrew, meadow

jumping mouse, southern bog lemming, and, to a lesser extent, the meadow vole generally prefer more mesic grasslands (Hoffmeister 1989). Eastern cottontails and woodchucks are most abundant where grassland habitat occurs in proximity to other habitat types and may be considered edge species. Other species use a variety of grassland habitats opportunistically.

Threatened and Endangered Species

None of the mammal species primarily associated with grasslands in the IRBAA is listed as threatened or endangered in Illinois.

Exotics

The Norway rat and house mouse are strongly associated with human structures, but both species may be found in grasslands in proximity to such structures. The house mouse in particular can sometimes reach substantial numbers in grasslands near buildings. These species are now so widespread that they are part of the mammalian fauna throughout the United States. Not much can be done to alter this situation and it is not one for concern. On the other hand, domesticated pets, particularly free ranging and feral housecats, can have severe negative impacts on grassland-nesting songbirds, rabbits, and possibly other small mammals.

Information Gaps

Additional information on the distribution and population status of the Franklin's ground squirrel, western harvest mouse, southern bog lemming, meadow jumping mouse, and least weasel would be useful. Franklin's ground squirrel, in particular, appears to have become uncommon throughout much of its former range in Illinois. The status of the badger in Illinois was recently investigated by Warner and Ver Steeg (1995), but population status in the IRBAA should be determined more precisely. Although the red fox is not strictly a grassland species, it is most often associated with grasslands and other open habitats. There are suggestions that recent increases in the abundance of coyotes could have negatively affected populations of red fox, and status of red fox populations in the IRBAA should be evaluated.

Enhancement and Restoration Potential

Restored grasslands could provide valuable sites for re-introductions of Franklin's ground squirrels in areas where they no longer occur. Prairie restoration, coupled with the preservation of native prairie and other grassland habitats, would provide additional habitat for badger and red fox.

Amphibians and Reptiles

Introduction

Information in this section has been compiled from range maps in Smith (1961), the Illinois Natural Heritage Database (Illinois Department of Natural Resources 1997), the Illinois Amphibian and Reptile Vouchered Database (an Illinois Natural History Survey computer database that contains information on specimens from museum, university, and private collections), unvouchered records from the literature, and unvouchered records taken from reliable biologists and naturalists. There has not been a systematic survey of the amphibians and reptiles of the Illinois River Bluffs Assessment Area (IRBAA). The IRBAA contains portions of 2 of Smith's (1961) 11 Herpetofaunal Divisions for the state; Grand Prairie and Woodlands of the Grand Prairie.

Amphibian and reptile species that are known or likely to occur in the IRBAA are listed in Table 16. The 13 amphibian species and 26 reptile species in Table 16 represent 33% of the amphibian species and 43% of the reptile species of the State. The state threatened western hognose snake, *Heterodon nasicus*, is known to exist in the vicinity of the IRBAA, but is probably not found within its borders. Its absence is mainly due to the lack of extensive sand deposits, especially sand prairies. One other state endangered species, the eastern massasauga, *Sistrurus catenatus*, has been extirpated from the IRBAA. There have been no reports of exotic reptile species in the IRBAA.

When referring to the habitat designations in Table 16, keep in mind that most amphibian and reptile species are not restricted to a single habitat type. For example, all but two of Illinois' amphibians require some type of aquatic habitat (wetland, pond, creek, or river) for breeding but the adults can also be found in a variety of terrestrial habitats. Some species require a combination of two habitat types throughout their life. For example, the smooth green snake requires prairie or forest habitat, but wetlands must be present. On the other hand, some species have narrower habitat requirements than the designations in Table 16 might suggest. For example, the queen snake is listed as occurring in rivers and creeks, but it is only found in medium-sized creeks with rocky substrates.

Forest

Typical Species

Amphibian species of the IRBAA that are typical of forested habitats include the spring peeper and both species of gray treefrog. As outlined above, most amphibians also require aquatic habitats for breeding. The gray treefrog and spring peeper breed in forested wetlands and upland forested ponds. Among the reptiles of the IRBAA, the brown snake is typical of forested areas.

Table 16. Amphibian and reptile species known or likely to occur in the Illinois River Bluffs Assessment Area, with an indication of habitat preference and relative abundance.

Common Name ¹	Scientific Name	Habitat ²	Abundance ³
Amphibians			
tiger salamander	<i>Ambystoma tigrinum</i>	F,W,P,L	U
mudpuppy	<i>Necturus maculosus</i>	L,R	U
American toad	<i>Bufo americanus</i>	U	C
Fowler's toad	<i>Bufo woodhousii</i>	F,W,P	C
cricket frog	<i>Acris crepitans</i>	L,R	C
striped chorus frog	<i>Pseudacris triseriata</i>	U	C
spring peeper	<i>Pseudacris crucifer</i>	F,W	C
Cope's gray treefrog	<i>Hyla chrysoscelis</i>	F,W	C
eastern gray treefrog	<i>Hyla versicolor</i>	F,W	C
bullfrog	<i>Rana catesbeiana</i>	U	C
green frog	<i>Rana clamitans</i>	F,W,R	C
northern leopard frog	<i>Rana pipiens</i>	F,W,P	U
plains leopard frog	<i>Rana blairi</i>	W,P	U
Reptiles			
snapping turtle	<i>Chelydra serpentina</i>	W,L,R	C
musk turtle	<i>Sternotherus odoratus</i>	W,L,R	U
painted turtle	<i>Chrysemys picta</i>	W,L,R	C
slider	<i>Trachemys scripta</i>	W,L,R	C
Blanding's turtle	<i>Emydoidea blandingii</i>	W	R
false map turtle	<i>Graptemys pseudogeographica</i>	L,R	C
map turtle	<i>Graptemys geographica</i>	L,R	C
spiny softshell turtle	<i>Apalone spinifera</i>	W,L,R	U
smooth softshell turtle	<i>Apalone mutica</i>	L,R	R
slender glass lizard	<i>Ophisaurus attenuatus</i>	P	R
six-lined racerunner	<i>Cnemidophorus sexlineatus</i>	P	U
eastern hognose snake	<i>Heterodon platirhinos</i>	F,W,P	U
racer	<i>Coluber constrictor</i>	U	U
smooth green snake	<i>Opheodrys vernalis</i>	W,P	U
rat snake	<i>Elaphe obsoleta</i>	F,W,P	U
fox snake	<i>Elaphe vulpina</i>	W,P,C	C
bullsnake	<i>Pituophis catenifer</i>	P	U
milk snake	<i>Lampropeltis triangulum</i>	F,W,P	U
plains garter snake	<i>Thamnophis radix</i>	U	C
common garter snake	<i>Thamnophis sirtalis</i>	U	C
brown snake	<i>Storeria dekayi</i>	U	C
red-bellied snake	<i>Storeria occipitomaculata</i>	F,W	U
Graham's crayfish snake	<i>Regina grahamii</i>	W,L	U
queen snake	<i>Regina septemvittata</i>	R	U
northern water snake	<i>Nerodia sipedon</i>	U	C
diamondback water snake	<i>Nerodia rhombifer</i>	R	U

¹ Nomenclature follows Collins (1990) unless noted.

² Habitats: F = forest, W = wetland, P = prairie and savanna, L = lakes, ponds, impoundments, R = rivers & creeks, C = cultural, U = ubiquitous (all habitats).

³ Abundance: C = common, U = uncommon, R = rare.

Enhancement and Restoration Potential

Maintaining small, temporary, fishless ponds in forests of the IRBAA would benefit many of the reptiles and amphibians of the IRBAA as well as other species groups that depend on them for food. Creating or restoring small, fishless ponds in upland forests is particularly valuable because these habitats are among the rarest in the IRBAA and the state. The tiger salamander, spring peeper, American toad, gray treefrog, and northern leopard frog are among the amphibians that breed in this habitat. The musk turtle, rat snake, brown snake, red-bellied snake, and northern water snake would benefit from restoration or creation of woodland ponds.

Wetland

Typical Species

Amphibian species of the IRBAA that are typical of wetland habitats include the green frog and northern leopard frog. As outlined above, almost all amphibians require some type of aquatic habitat for breeding and most breed in wetlands. Among the reptiles of the IRBAA, the painted turtle, Blanding's turtle, and common garter snake are typical of wetlands. These species reach their greatest abundance in wetland habitats.

Enhancement and Restoration Potential

Maintaining even small, temporary wetlands in the IRBAA would benefit almost all of the reptiles and amphibians of the region, as well as other groups that depend on them for food. The importance of cattail marshes under one acre should not be underestimated. Species such as the plains leopard frog, striped chorus frog and American toad can often utilize small, seemingly isolated wetlands. These species have excellent dispersal abilities and can move from wetland to wetland across inhospitable terrain such as agricultural fields and vacant lots. For most amphibians, however, agricultural fields and vacant lots are barriers to dispersal. For these species to persist in the landscape, small wetlands must be connected to other wetlands by corridors of natural vegetation. For this reason, mowing in the vicinity of wetlands should be avoided and grassy filter strips should be planted and greenways developed, especially along rivers and creeks.

Information Gaps

One of the most pressing questions concerning wetland amphibians and reptiles in the IRBAA is whether the Blanding's turtle still exists in this area. This large aquatic turtle was once very common in the upper and middle Illinois River valley, but wetland destruction and contamination have reduced its numbers dramatically. In the IRBAA, the Blanding's turtle is at home in prairie marshes and floodplain sloughs of the Illinois River. It is most commonly found in shallow (10-20 cm) open water areas of cattail

marshes, sloughs, ponds, and flooded ditches. Aquatic plants, especially emergent vegetation and a mud bottom are important habitat components. The activity period in mid-Illinois is probably late March to October. Nesting occurs in June in sandy, well drained soil near the aquatic habitat. Hatching usually takes place in September. An effort should be made to determine if this species still exists in the IRBAA, so that appropriate management action can be taken.

Prairie

Typical Species

Of the amphibian species listed in Table 16, the tiger salamander and striped chorus frog are typical of prairie habitats in the IRBAA. The tiger salamander requires fishless ponds and wetlands for breeding. Because of the destruction and degradation of these habitats, the tiger salamander has declined in the IRBAA. The striped chorus frog has a shorter larval period and therefore can breed in more temporary aquatic habitats such as flooded fields and ditches. Reptile species in the IRBAA that are typical of prairie habitats include the fox snake and plains garter snake. Both of these snakes can tolerate disturbed habitats such as mowed right-of-way, pasture, oldfield, and agricultural edge. The Blanding's turtle was once common in wet prairie habitats of the IRBAA, but this habitat has been almost completely eliminated.

Enhancement and Restoration Potential

Restoring native prairie, especially wet prairie, in the IRBAA would benefit a variety of amphibians and reptiles especially the tiger salamander, and the Blanding's turtle (if present in the IRBAA). Wet prairie habitats also provide homes for insects and small mammals, both of which are important food items for amphibians and reptiles.

Lakes, Ponds, and Impoundments

Typical Species

Of the amphibian species listed in Table 16, the bullfrog and cricket frog are typical of lakes, ponds, and impoundments in the IRBAA. Both of these species have developed strategies for co-existing with fish and are usually more widely distributed than other amphibians. Among the reptiles of the IRBAA, the snapping turtle, painted turtle, common garter snake, and northern water snake are typical of lakes, ponds, and impoundments.

Enhancement and Restoration Potential

Restoration of fishless, forested ponds in upland areas would benefit the tiger salamander and gray treefrog. Leaving at least part of the shore around ponds, lakes, and impoundments unmowed is vital for most amphibians because it provides cover and refugia from predators. Developing forest or grassland connections among ponds, lakes, and impoundments in the IRBAA would benefit a variety of amphibians and reptiles. By connecting the various ponds and lakes with each other and with larger blocks of natural vegetation, the effects of fragmentation and small population size can be lessened. If individuals can move among ponds, this makes the whole complex of ponds effectively one large habitat.

Creeks and Rivers

Typical Species

The cricket frog and green frog are typical of creeks and small rivers in the IRBAA, while the mudpuppy is a typical inhabitant of the Illinois River. Among the reptiles of the IRBAA, the northern water snake is typical of creeks and small rivers while the snapping turtle, both map turtles, both softshell turtles, and diamondback water snake are typical of the Illinois River.

Enhancement and Restoration Potential

Restoring the riparian zone and associated floodplain forests and wetlands along the Illinois River and its tributaries would benefit a variety of amphibians and reptiles. Water quality must also be improved if any significant progress is expected. In addition, if the Blanding's turtle still exists in the IRBAA, it is in the backwater sloughs of the Illinois River. These habitats have been adversely affected by siltation and agricultural runoff. Special effort should be made to survey the sloughs for the existence of the Blanding's turtle.

Cultural Habitats

Typical Species

Of the amphibian species listed in Table 16, the American toad, striped chorus frog, and bullfrog are typical of cultural habitats in the IRBAA. These species can be found in cropland, pasture, successional field, developed land, and tree plantations providing that adequate breeding sites (ditches, flooded fields, stock tanks, remnant marshes) are present. Among the reptiles of the IRBAA, the plains garter snake, common garter snake, brown snake, and northern water snake are typical of cultural habitats in the IRBAA.

Enhancement and Restoration Potential

The American toad, striped chorus frog, and bullfrog do well in patches of cattail marsh under one acre, even when the marsh is surrounded by developed land. These species have excellent dispersal abilities and can move from wetland to wetland across inhospitable terrain such as agricultural fields and vacant lots. It is always best to strive for larger size and connectivity of habitat, but the utility of these smaller areas should not be underestimated. It is also important to leave a moderate buffer of unmowed grass around these habitats to provide cover and refugia from predators.

Overall Habitat Quality and Management Concerns

Overall, opportunities for amphibians and reptiles in the IRBAA are fair. Illinois River backwaters, although somewhat degraded, still provide habitat for many species. Compared to pre-settlement, the present landscape of the IRBAA lacks a significant amount of wet prairie and the riparian zone along the Illinois River has been reduced and degraded. Nonetheless, the river still provides dispersal opportunities for many species. This keeps the effects of fragmentation to a minimum, especially by providing a means of recolonization of habitats that have experienced local extinction. For this reason, the Illinois River is the thread that ties the whole IRBAA together.

The most critical management concerns for the IRBAA Partnership are restoration of the riparian zone and backwater sloughs along the Illinois River. As discussed above, intact riparian zones act as dispersal corridors for many amphibians and reptiles, thus reducing the effects of habitat fragmentation.

Aquatic Biota

Introduction

The Illinois River Bluffs Assessment Area (IRBAA) contains a portion of the Illinois River in north-central Illinois and several Illinois River tributaries, including Senachwine Creek, Crow Creek West, Crow Creek East, Clear Creek, Sandy Creek, and other small streams. These streams drain parts of eight Illinois counties: Marshall, Bureau, Putnam, Stark, LaSalle, Woodford, Peoria, and Tazewell.

Approximately 45% of Illinois is drained by the Illinois River. The natural drainage area totals about 30,000 square miles, of which 24,000 square miles are in Illinois. The river rises at the confluence of the Kankakee and Des Plaines rivers and flows 273 miles in a westerly and southerly direction, emptying into the Mississippi River at Grafton. The Illinois River is the largest tributary of the Mississippi River above the mouth of the Missouri River.

The Illinois River and its valley is an area that has been and remains subject to human disturbances. Until the turn of the century the Illinois River remained relatively unblemished and the waters provided a livelihood for many adjacent communities. In 1908, 2500 commercial fishermen took nearly 24 million pounds of fish from the Illinois (Havera and Bellrose, 1985). The river was one of the most productive mussel streams per mile in the United States; in 1910, over 2600 mussel-fishing boats plied the Illinois River (Coker, 1919). Abundant waterfowl in the fall made the valley a mecca for commercial and sport hunters. As the human population increased in the basin, the prolific days of the river were ended.

The banks along the lower Illinois River once were lined with hundreds of lakes and backwaters. The river valley resembled a boundless marsh. Today an acceleration of the sedimentation process has reduced the average depth of the backwaters to two feet, and many of the lakes are becoming mudflats (Talkington, 1991). The soils along the Illinois River are poorly drained and alkaline to slightly acidic. They range from sandy to clay deposits and, in some areas, the soil is entirely sand. Away from the Illinois River the soils have developed up to five feet of loess.

The opening of the Chicago Sanitary and Ship Canal in 1900 diverted water from Lake Michigan to the Illinois River. This resulted in thousands of acres of bottomland forests being flooded, eventually killing the forests. Vast quantities of untreated sewage and industrial waste were flushed into the Illinois River through the Chicago Sanitary and Ship Canal to prevent contamination of Lake Michigan. By 1923 the river contained very little oxygen as far downstream as Peoria (Havera and Bellrose, 1985). Between 1920 and 1940, 41 drainage and levee districts were developed and six dams were built. These slowed the flow of water, increased flooding, and destroyed many of the

backwaters in the Lower River. By 1938 the large scale changes of the Illinois River and the valley were complete (Havera and Bellrose, 1985).

Today the Illinois River basin includes 46% of the state's agricultural land, 28% of its forests, 37% of its surface waters, and 95% of its urban areas (Talkington, 1991). Sedimentation is the major pollutant of the river and causes increased flooding, filling in of backwater lakes, and a reduction in aquatic vegetation. The sediment also carries pesticides, herbicides, and fertilizers that further degrade the water quality. Disappearances of benthic diversity and aquatic vegetation combined with increasing turbidity, pollution, and draining of breeding and feeding habitats have taken their toll on the river (Page et al. 1992).

Statewide Comparison of Aquatic Biota

The Illinois Bluffs Region historically supported a high diversity of aquatic species, including 88 species of fishes, 35 species of mussels, and 14 species of malacostracans (large crustaceans). Fifty-three species of fishes, six mussels, and 13 malacostracans have been reported from Illinois River tributaries in this region. Eighty-two species of fishes, 33 mussels, and 5 malacostracans have been reported from the Illinois River proper, including records for two state endangered/threatened fishes and four state endangered/threatened mussels. With improvements in water quality and habitat protection, populations of endangered or threatened species could increase, and natural communities could become reestablished in areas where they have been eliminated or altered.

The IRBAA likely supports a moderate diversity of other aquatic macroinvertebrates. Unfortunately, existing distributional data and information on natural community associations is inadequate to summarize typical, unique, or rare species, or to identify exotic species. Surveys of aquatic macroinvertebrate populations have been limited to selected sites within the boundaries of this assessment area. In particular, surveys for aquatic macroinvertebrates were conducted by Illinois Natural History Survey (INHS) personnel during October and November of 1984 and again in April and May of 1985 in conjunction with environmental assessments for terrestrial and aquatic resources in the vicinity of the U.S. Route 51 and Interstate 39 highway corridors between Bloomington / Normal in McLean County and LaSalle / Peru in LaSalle County (Wetzel 1986). During that study, aquatic macro-invertebrates, fishes, unionid mollusks, phytoplankton and zooplankton communities, and water quality were surveyed at eight sites in and around the IRBAA. Of these, one (Sandy Creek - Illinois River drainage) was located in Marshall County, three (Panther Creek, East Branch Panther Creek, and Mackinaw River - Illinois River drainage) were located in Woodford County, and one (Bailey Creek - Illinois River drainage) was located in LaSalle County.

Common Species

Eighty-eight species of fishes are known from the region (Tables 17 and 18). Common fishes in the Illinois River are gizzard shad, carp, emerald shiners, bullhead minnows,

smallmouth buffalos, quillbacks, channel catfish, largemouth bass, white and black crappies, logperch, and freshwater drum. Common fishes in the tributaries include bigmouth shiners, red shiners, sand shiners, central stonerollers, bluntnose minnows, golden redhorse, white suckers, green sunfish, bluegills, and johnny darters. Headwaters contain creek chubs and orangethroat darters and, where spring-fed, populations of southern redbelly dace and blacknose dace.

The Illinois Bluffs assessment area historically supported 35 species of mussels (Table 19 and 20), but only three native species (white heelsplitter, giant floater, and fat mucket) have been found alive since 1969, all 3 of which are common statewide (Cummings and Mayer, 1997). In a survey of the Illinois River by INHS biologists from 1993 to 1995, a total of 12 species were found in the Peoria Reach, of which Illinois Bluffs is a part. The three most common species found in the Peoria Reach were: the threeridge, mapleleaf and giant floater (Whitney et al. 1997), all of three of which are widespread and common statewide.

Fourteen species of crayfishes, isopods, and amphipods are found in the IRBAA (Table 21 and 22). The most common crayfish is the virile crayfish, which usually is found over rocky substrates or around woody debris or vegetation. The white river crayfish and calico crayfish, both of which are found in vegetation or debris in quiet pools of streams, also are fairly common. The most common isopod is *Caecidotea intermedia*, which lives in rocky areas and on woody debris. The most common amphipods are *Hyaella azteca*, which is found on vegetation, usually filamentous algae growing on rocks or logs, and *Gammarus pseudolimnaeus*, which lives in spring-fed headwaters. None of these 14 species of crustaceans is considered threatened or endangered.

Table 23 lists aquatic macroinvertebrate taxa known or thought likely to occur in the IRBAA based upon records from one or more location within the study area. Most of these species are considered relatively common in the state of Illinois. Records for species included in Table 23 have been obtained from the following sources: Pechuman et al. (1983), Malloch (1915a, b), Frison (1935), Ross (1944), Burks (1953), Wooldridge (1967), Lauck (1959), W. Brigham (unpubl.), Wetzel (1986), Taylor (1996), and the INHS Collections.

Although many of the species listed in Table 23 are known to occur in both standing and running water, the paucity of accessible historical records and the limited recent information for taxa known to occur within the the IRBAA make it difficult to associate most taxa with specific habitat types, such as headwaters, larger streams, small or medium reaches of rivers, or with standing water habitats such as ponds, lakes, and reservoirs.

Current literature discussing federal and state listed threatened and endangered species, species under consideration for such listing, or other species considered rare or of special concern (Herkert 1992, 1994; Illinois Endangered Species Protection Board 1994; U.S. Department of Interior, Fish and Wildlife Service 1996) does not include any aquatic macroinvertebrate species other than unionid mussels known or thought likely to occur in the IRBAA.

Table 17. Freshwater fishes recorded from the Illinois River Bluffs Assessment Area¹.

FAMILY				Small	Medium	Standing
<i>Scientific Name</i> ^{2,3,4}		Headwaters	Creeks	Rivers	Rivers	Water
PETROMYZONTIDAE						
<i>Ichthyomyzon castaneus</i>	chestnut lamprey			X	X	
<i>Ichthyomyzon unicuspis</i>	silver lamprey				X	
POLYODONTIDAE						
<i>Polyodon spathula</i>	paddlefish				X	
LEPISOSTEIDAE						
<i>Lepisosteus oculatus</i>	spotted gar				X	X
<i>Lepisosteus osseus</i>	longnose gar				X	
<i>Lepisosteus platostomus</i>	shortnose gar				X	
AMIIDAE						
<i>Amia calva</i>	bowfin				X	X
HIODONTIDAE						
<i>Hiodon alosoides</i>	goldeye				X	
ANGUILLIDAE						
<i>Anguilla rostrata</i>	American eel				X	
CLUPEIDAE						
<i>Alosa chrysochloris</i>	skipjack herring				X	
<i>Dorosoma cepedianum</i> #	gizzard shad			X	X	X
CYPRINIDAE						
<i>Campostoma anomalum</i> #	central stoneroller	X	X	X		
<i>Carassius auratus</i> *	goldfish		X	X	X	X
<i>Cyprinella lutrensis</i> #	red shiner		X	X	X	
<i>Cyprinella spiloptera</i>	spotfin shiner		X	X	X	
<i>Cyprinus carpio</i> * #	common carp			X	X	X
<i>Hybognathus nuchalis</i>	Mississippi silvery minnow		X	X	X	
<i>Luxilus chrysocephalus</i>	striped shiner	X	X	X	X	
<i>Lythrurus umbratilis</i>	redfin shiner		X	X	X	
<i>Macrhybopsis storeriana</i>	silver chub				X	
<i>Nocomis biguttatus</i>	hornyhead chub		X	X		
<i>Notemigonus crysoleucas</i>	golden shiner			X		X
<i>Notropis atherinoides</i> #	emerald shiner				X	
<i>Notropis blennioides</i>	river shiner				X	
<i>Notropis bairdii</i>	ghost shiner			X	X	
<i>Notropis dorsalis</i> #	bigmouth shiner		X	X	X	
<i>Notropis hudsonius</i>	spottail shiner				X	
<i>Notropis ludibundus</i> #	sand shiner		X	X	X	
<i>Notropis rubellus</i>	rosyface shiner		X	X	X	
<i>Notropis texanus</i> SE	weed shiner		X			
<i>Opsopoeodus emiliae</i>	pugnose minnow		X	X		X
<i>Phenacobius mirabilis</i>	suckermouth minnow		X	X	X	
<i>Phoxinus erythrogaster</i>	southern redbelly dace	X				
<i>Pimephales notatus</i> #	bluntnose minnow	X	X	X	X	
<i>Pimephales promelas</i>	fathead minnow		X	X		
<i>Pimephales vigilax</i> #	bullhead minnow			X	X	

Table 17. Continued

FAMILY						
<i>Scientific Name</i> ^{2,3,4}		Headwaters	Creeks	Small Rivers	Medium Rivers	Standing Water
<i>Rhinichthys atratulus</i>	blacknose dace	X	X			
<i>Semotilus atromaculatus</i> #	creek chub	X	X			
CATOSTOMIDAE						
<i>Carpiodes carpio</i>	river carpsucker			X	X	
<i>Carpiodes cyprinus</i> #	quillback		X	X	X	
<i>Carpiodes velifer</i>	highfin carpsucker			X	X	
<i>Catostomus commersoni</i> #	white sucker		X	X	X	
<i>Hypentelium nigricans</i>	northern hog sucker		X	X	X	
<i>Ictiobus bubalus</i> #	smallmouth buffalo				X	
<i>Ictiobus cyprinellus</i>	bigmouth buffalo				X	
<i>Ictiobus niger</i>	black buffalo				X	
<i>Moxostoma anisurum</i>	silver redhorse			X	X	
<i>Moxostoma erythrurum</i> #	golden redhorse		X	X	X	
<i>Moxostoma macrolepidotum</i>	shorthead redhorse			X	X	
ICTALURIDAE						
<i>Ameiurus melas</i>	black bullhead		X	X	X	X
<i>Ameiurus natalis</i>	yellow bullhead		X	X	X	X
<i>Ameiurus nebulosus</i>	brown bullhead					X
<i>Ictalurus punctatus</i> #	channel catfish			X	X	X
<i>Noturus flavus</i>	stonecat		X	X		
<i>Noturus gyrinus</i>	tadpole madtom		X	X		
ESOCIDAE						
<i>Esox lucius</i>	northern pike			X	X	X
UMBRIDAE						
<i>Umbra limi</i>	central mudminnow		X			X
SALMONIDAE						
<i>Coregonus artedii</i> ST	cisco					X
PERCOPSIDAE						
<i>Percopsis omiscomaycus</i>	trout-perch				X	
APHREDODERIDAE						
<i>Aphredoderus sayanus</i>	pirate perch		X			
FUNDULIDAE						
<i>Fundulus dispar</i>	starhead topminnow		X			X
<i>Fundulus notatus</i>	blackstripe topminnow		X	X	X	
POECILIIDAE						
<i>Gambusia affinis</i>	mosquitofish	X	X			X
MORONIDAE						
<i>Morone americana</i>	white perch			X	X	
<i>Morone chrysops</i>	white bass			X	X	
CENTRARCHIDAE						
<i>Ambloplites rupestris</i>	rock bass		X	X	X	
<i>Lepomis cyanellus</i> #	green sunfish		X	X	X	X
<i>Lepomis gibbosus</i>	pumpkinseed		X	X	X	X

Table 17. Continued

FAMILY			Small	Medium	Standing
<i>Scientific Name</i> ^{2,3,4}		Headwaters	Rivers	Rivers	Water
<i>Lepomis gulosus</i>	warmouth		X	X	X
<i>Lepomis humilis</i>	orangespotted sunfish		X	X	
<i>Lepomis macrochirus</i> #	bluegill		X	X	X
<i>Micropterus dolomieu</i>	smallmouth bass		X	X	X
<i>Micropterus salmoides</i> #	largemouth bass		X	X	X
<i>Pomoxis annularis</i> #	white crappie		X	X	X
<i>Pomoxis nigromaculatus</i> #	black crappie		X	X	X
PERCIDAE					
<i>Etheostoma asprigene</i>	mud darter		X	X	
<i>Etheostoma caeruleum</i>	rainbow darter	X	X	X	
<i>Etheostoma chlorosomum</i>	bluntnose darter		X	X	
<i>Etheostoma flabellare</i>	fantail darter	X	X		
<i>Etheostoma nigrum</i> #	johnny darter	X	X	X	
<i>Etheostoma spectabile</i> #	orangethroat darter	X	X		
<i>Perca flavescens</i>	yellow perch		X		X
<i>Percina caprodes</i> #	logperch		X	X	
<i>Percina maculata</i>	blackside darter	X	X	X	
<i>Percina phoxocephala</i>	slenderhead darter		X	X	
<i>Stizostedion canadense</i>	sauger		X	X	
<i>Stizostedion vitreum</i>	walleye		X	X	
SCIAENIDAE					
<i>Aplodinotus grunniens</i> #	freshwater drum		X	X	

¹Data from the Illinois Natural History Survey Fish Collection.²Bold type indicates a State Endangered Species (SE); State Threatened Species (ST).³* = non-native species; # = common species.⁴Total number of species = 88 (86 native, 2 introduced).Table 18. Freshwater fishes recorded from the Illinois River Bluffs Assessment Area, by habitat¹.

FAMILY		Streams			Standing Water	
<i>Scientific Name</i> ^{2,3,4}		Riffles	Runs	Pools	Littoral	Open Water
PETROMYZONTIDAE						
<i>Ichthyomyzon castaneus</i>	chestnut lamprey	X	X			
<i>Ichthyomyzon unicuspis</i>	silver lamprey	X	X			
POLYODONTIDAE						
<i>Polyodon spathula</i>	paddlefish			X		X
LEPISOSTEIDAE						
<i>Lepisosteus oculatus</i>	spotted gar			X	X	X
<i>Lepisosteus osseus</i>	longnose gar				X	
<i>Lepisosteus platostomus</i>	shortnose gar		X		X	X
AMIIDAE						
<i>Amia calva</i>	bowfin			X	X	

Table 18. Continued

FAMILY	Scientific Name ^{2,3,4}	Streams			Standing Water	
		Riffles	Runs	Pools	Littoral	Open Water
HIODONTIDAE						
	<i>Hiodon alosoides</i>			X	X	
ANGUILLIDAE						
	<i>Anguilla rostrata</i>			X	X	
CLUPEIDAE						
	<i>Alosa chrysochloris</i>			X	X	
	<i>Dorosoma cepedianum</i> #			X		X
CYPRINIDAE						
	<i>Campostoma anomalum</i> #	central stoneroller	X	X		
	<i>Carassius auratus</i> *	goldfish			X	
	<i>Cyprinella lutrensis</i> #	red shiner		X	X	
	<i>Cyprinella spiloptera</i>	spotfin shiner		X	X	
	<i>Cyprinus carpio</i> * #	common carp			X	
	<i>Hybognathus nuchalis</i>	Mississippi silvery minnow		X	X	
	<i>Luxilus chrysocephalus</i>	striped shiner		X	X	
	<i>Lythrurus umbratilis</i>	redfin shiner		X	X	
	<i>Macrhybopsis storeriana</i>	silver chub			X	
	<i>Nocomis biguttatus</i>	hornyhead chub	X	X		
	<i>Notemigonus crysoleucas</i>	golden shiner			X	X
	<i>Notropis atherinoides</i> #	emerald shiner			X	
	<i>Notropis blennius</i>	river shiner		X	X	
	<i>Notropis buchanani</i>	ghost shiner			X	
	<i>Notropis dorsalis</i> #	bigmouth shiner	X	X		
	<i>Notropis hudsonius</i>	spottail shiner			X	X
	<i>Notropis ludibundus</i> #	sand shiner		X	X	
	<i>Notropis rubellus</i>	rosyface shiner		X	X	X
	<i>Notropis texanus</i> SE	weed shiner		X	X	
	<i>Opsopoeodus emiliae</i>	pugnose minnow			X	
	<i>Phenacobius mirabilis</i>	suckermouth minnow	X	X		
	<i>Phoxinus erythrogaster</i>	southern redbelly dace	X	X		
	<i>Pimephales notatus</i> #	bluntnose minnow		X	X	
	<i>Pimephales promelas</i>	fathead minnow			X	
	<i>Pimephales vigilax</i> #	bullhead minnow		X	X	
	<i>Rhinichthys atratulus</i>	blacknose dace	X	X		
	<i>Semotilus atromaculatus</i> #	creek chub			X	
CATOSTOMIDAE						
	<i>Carpiodes carpio</i>	river carpsucker		X	X	
	<i>Carpiodes cyprinus</i> #	quillback		X	X	
	<i>Carpiodes velifer</i>	highfin carpsucker		X	X	
	<i>Catostomus commersoni</i> #	white sucker		X	X	
	<i>Hypentelium nigricans</i>	northern hog sucker	X	X		
	<i>Ictiobus bubalus</i> #	smallmouth buffalo			X	
	<i>Ictiobus cyprinellus</i>	bigmouth buffalo			X	
	<i>Ictiobus niger</i>	black buffalo			X	

Table 18. Continued

FAMILY Scientific Name ^{2,3,4}		Streams			Standing Water	
		Riffles	Runs	Pools	Littoral	Open Water
<i>Moxostoma anisurum</i>	silver redhorse		X	X		
<i>Moxostoma erythrurum</i> #	golden redhorse		X	X		
<i>Moxostoma macrolepidotum</i>	shorthead redhorse		X	X		
ICTALURIDAE						
<i>Ameiurus melas</i>	black bullhead			X	X	
<i>Ameiurus natalis</i>	yellow bullhead			X	X	
<i>Ameiurus nebulosus</i>	brown bullhead				X	
<i>Ictalurus punctatus</i> #	channel catfish		X	X	X	
<i>Noturus flavus</i>	stonecat	X				
<i>Noturus gyrinus</i>	tadpole madtom		X	X		
ESOCIDAE						
<i>Esox lucius</i>	northern pike			X	X	
UMBRIDAE						
<i>Umbra limi</i>	central mudminnow			X	X	
SALMONIDAE						
<i>Coregonus artedii</i> ST	cisco					X
PERCOPSIDAE						
<i>Percopsis omiscomaycus</i>	trout-perch		X	X		
APHREDODERIDAE						
<i>Aphredoderus sayanus</i>	pirate perch			X		
FUNDULIDAE						
<i>Fundulus dispar</i>	starhead topminnow				X	
<i>Fundulus notatus</i>	blackstripe topminnow			X		
POECILIIDAE						
<i>Gambusia affinis</i>	mosquitofish			X	X	
MORONIDAE						
<i>Morone americana</i>	white perch			X		
<i>Morone chrysops</i>	white bass			X		
CENTRARCHIDAE						
<i>Ambloplites rupestris</i>	rock bass			X		
<i>Lepomis cyanellus</i> #	green sunfish			X		X
<i>Lepomis gibbosus</i>	pumpkinseed			X		
<i>Lepomis gulosus</i>	warmouth			X	X	
<i>Lepomis humilis</i>	orangespotted sunfish			X		
<i>Lepomis macrochirus</i> #	bluegill			X	X	
<i>Micropterus dolomieu</i>	smallmouth bass			X	X	X
<i>Micropterus salmoides</i> #	largemouth bass			X	X	X
<i>Pomoxis annularis</i> #	white crappie			X	X	X
<i>Pomoxis nigromaculatus</i> #	black crappie			X	X	X
PERCIDAE						
<i>Etheostoma asprigene</i>	mud darter	X		X		
<i>Etheostoma caeruleum</i>	rainbow darter	X				
<i>Etheostoma chlorosomum</i>	bluntnose darter			X	X	
<i>Etheostoma flabellare</i>	fantail darter	X				

Table 18. Continued

FAMILY <i>Scientific Name</i> ^{2,3,4}		Streams			Standing Water	
		Riffles	Runs	Pools	Littoral	Open Water
<i>Etheostoma nigrum</i> #	johnny darter		X	X		
<i>Etheostoma spectabile</i> #	orangethroat darter	X		X		
<i>Perca flavescens</i>	yellow perch			X	X	
<i>Percina caprodes</i> #	logperch		X	X		
<i>Percina maculata</i>	blackside darter			X		
<i>Percina phoxocephala</i>	slenderhead darter	X	X			
<i>Stizostedion canadense</i>	sauger			X		
<i>Stizostedion vitreum</i>	walleye			X		
SCIAENIDAE						
<i>Aplodinotus grunniens</i> #	freshwater drum			X		

¹Data from the Illinois Natural History Survey Fish Collection.²Bold type indicates a State Endangered Species (SE); State Threatened Species (ST).³* = non-native species; # = common species.⁴Total number of species = 88 (86 native, 2 introduced).Table 19. Freshwater mussels recorded from the Illinois River Bluffs Assessment Area¹.

ORDER		Headwaters/ Creeks	Small Rivers	Medium Rivers	Standing Water
Subfamily	<i>Scientific Name</i> ^{2,3,4}				
UNIONIDAE					
Anodontinae					
	<i>Alasmidonta marginata</i>	elktoe	X	X	
	<i>Anodonta suborbiculata</i>	flat floater			X
	<i>Arcidens confragosus</i>	rock-pocketbook		X	
	<i>Lasmigona complanata</i>	white heelsplitter	X	X	X
	<i>Pyganodon grandis</i> #	giant floater	X	X	X
	<i>Utterbackia imbecillis</i>	paper pondshell		X	X
Ambleminae					
	<i>Amblema plicata</i> #	threeridge	X	X	
	<i>Cyclonaias tuberculata</i>	purple wartyback		X	
	<i>Elliptio dilatata</i> ST	spike	X	X	
	<i>Fusconaia ebena</i> ST	ebonyshell		X	
	<i>Fusconaia flava</i>	Wabash pigtoe	X	X	
	<i>Megaloniais nervosa</i>	washboard		X	
	<i>Pleurobema sintoxia</i>	round pigtoe	X	X	
	<i>Quadrula metanevra</i>	monkeyface		X	
	<i>Quadrula nodulata</i>	wartyback		X	
	<i>Quadrula pustulosa</i>	pimpleback	X	X	
	<i>Quadrula quadrula</i> #	mapleleaf	X	X	
	<i>Tritogonia verrucosa</i>	pistolgrip	X	X	
Lampsilinae					
	<i>Actinonaias ligamentina</i>	mucket	X	X	

Table 19. Continued

ORDER	Subfamily		Headwaters/ Creeks	Small Rivers	Medium Rivers	Standing Water
	Scientific Name ^{2,3,4}					
	<i>Ellipsaria lineolata</i> ST	butterfly			X	
	<i>Lampsilis higginsii</i> SE FE	Higgins eye		X	X	
	<i>Lampsilis siliquoidea</i>	fatmucket		X	X	X
	<i>Lampsilis teres</i>	yellow sandshell		X	X	
	<i>Leptodea fragilis</i>	fragile papershell		X	X	
	<i>Leptodea leptodon</i>	scaleshell			X	
	<i>Ligumia recta</i>	black sandshell			X	
	<i>Obliquaria reflexa</i>	threehorn wartyback			X	
	<i>Obovaria olivaria</i>	round hickorynut			X	
	<i>Potamilus alatus</i>	pink heelsplitter		X	X	
	<i>Potamilus ohiensis</i>	pink papershell		X	X	
	<i>Toxolasma parvus</i>	lilliput	X	X	X	X
	<i>Truncilla donaciformis</i>	fawnsfoot			X	
	<i>Truncilla truncata</i>	deertoe			X	
DREISSENIDAE						
	<i>Dreissena polymorpha</i> *	zebra mussel			X	
CORBICULIDAE						
	<i>Corbicula fluminea</i> *	Asian clam	X	X	X	X

¹Data from the Illinois Natural History Survey Mollusk Collection.²Bold type indicates a State Endangered Species (SE); State Threatened Species (ST); Federally Endangered Species (FE).³* = non-native species; # = common species.⁴Total number of species = 35 (33 native, 2 introduced).Table 20. Freshwater mussels recorded from the Illinois River Bluffs Assessment Area, by habitat¹.

FAMILY	Subfamily		Streams			Standing Water
	Scientific Name ^{2,3,4}		Riffles	Runs	Pools	Littoral Zone
UNIONIDAE						
	Anodontinae					
	<i>Alasmodonta marginata</i>	elktoe	X	X		
	<i>Anodonta suborbiculata</i>	flat floater			X	X
	<i>Arcidens confragosus</i>	rock-pocketbook		X	X	
	<i>Lasmigona complanata</i>	white heelsplitter		X	X	X
	<i>Pyganodon grandis</i> #	giant floater		X	X	X
	<i>Uterbackia imbecillis</i>	paper pondshell		X	X	X
	Ambleminae					
	<i>Amblema plicata</i> #	threeridge	X	X	X	
	<i>Cyclonaias tuberculata</i>	purple wartyback	X	X		
	<i>Elliptio dilatata</i> ST	spike	X	X		
	<i>Fusconaia ebena</i> ST	ebonyshell	X	X		

Table 20. Continued

FAMILY		Streams			Standing Water
Subfamily		Riffles	Runs	Pools	Littoral Zone
Scientific Name ^{2,3,4}					
<i>Fusconaia flava</i>	Wabash pigtoe	X	X		
<i>Megalanaia nervosa</i>	washboard	X	X	X	
<i>Pleurobema sintoxia</i>	round pigtoe	X	X		
<i>Quadrula metanevra</i>	monkeyface	X	X		
<i>Quadrula nodulata</i>	wartyback	X	X		
<i>Quadrula pustulosa</i>	pimpleback	X	X		
<i>Quadrula quadrula</i> #	mapleleaf	X	X	X	
<i>Tritogonia verrucosa</i>	pistolgrip	X	X		
Lampsilinae					
<i>Actinonaias ligamentina</i>	mucket	X	X		
<i>Ellipsaria lineolata</i> ST	butterfly		X	X	
<i>Lampsilis higginsii</i> SE FE	Higgins eye		X	X	
<i>Lampsilis siliquoidea</i>	fatmucket	X	X	X	X
<i>Lampsilis teres</i>	yellow sandshell	X	X		
<i>Leptodea fragilis</i>	fragile papershell	X	X	X	
<i>Leptodea leptodon</i>	scaleshell		X		
<i>Ligumia recta</i>	black sandshell	X	X		
<i>Obliquaria reflexa</i>	threehorn wartyback	X	X	X	
<i>Obovaria olivaria</i>	round hickorynut	X	X		
<i>Potamilus alatus</i>	pink heelsplitter	X	X	X	
<i>Potamilus ohioensis</i>	pink papershell	X	X	X	
<i>Toxolasma parvus</i>	lilliput	X	X	X	X
<i>Truncilla donaciformis</i>	fawnsfoot	X	X		
<i>Truncilla truncata</i>	deertoe	X	X		
DREISSENIDAE					
<i>Dreissena polymorpha</i> *	zebra mussel		X	X	
CORBICULIDAE					
<i>Corbicula fluminea</i> *	Asian clam	X	X	X	X

¹Data from the Illinois Natural History Survey Mollusk Collection.

²Bold type indicates a State Endangered Species (SE); State Threatened Species (ST); Federally Endangered Species (FE).

³* = non-native species; # = common species.

⁴Total number of species = 35 (33 native, 2 introduced).

Table 21. Freshwater crustaceans recorded from the Illinois River Bluffs Assessment Area¹.

ORDER	Family	Scientific Name ^{2,3}	Common Name	Headwaters	Creeks	Small Rivers	Medium Rivers	Standing Water
ISOPODA (Isopods)								
	Asellidae							
		<i>Caecidotea intermedia</i> #			X	X	X	X
		<i>Caecidotea kendeighi</i>		Springs				
AMPHIPODA (Amphipods)								
	Crangonyctidae							
		<i>Bactrurus mucronatus</i>		Springs				
		<i>Crangonyx gracilis</i>						X
	Gammaridae							
		<i>Gammarus pseudolimnaeus</i> #		X				
	Hyalellidae							
		<i>Hyaella azteca</i> #		X	X	X	X	X
DECAPODA (Crayfishes & shrimps)								
	Palaemonidae							
		<i>Palaemonetes</i>						
		<i>kadiakensis</i>	Mississippi grass shrimp		X	X	X	X
	Cambaridae							
		<i>Procambarus acutus</i> #	White River crawfish		X	X	X	X
		<i>Procambarus gracilis</i>	prairie crayfish			burrower		
		<i>Orconectes immunis</i> #	calico crayfish	X	X	X	X	X
		<i>Orconectes propinquus</i>	clearwater crayfish		X	X	X	
		<i>Orconectes rusticus</i> *	rusty crayfish		X	X	X	X
		<i>Orconectes virilis</i> #	virile crayfish		X	X	X	X
		<i>Cambarus diogenes</i>	devil crawfish			burrower		

¹Data from the Illinois Natural History Survey Crustacean Collection.

²* = non-native species; # = common species.

³Total number of species = 14 (13 native, 1 introduced).

Table 22. Freshwater crustaceans recorded from the Illinois River Bluffs Assessment Area, by habitat¹.

ORDER Family <i>Scientific Name</i> ^{2,3}	Streams			Standing Water	
	Riffles	Runs	Pools	Littoral	Open Water
ISOPODA (Isopods)					
Asellidae					
<i>Caecidotea intermedia</i> #	X		X		
<i>Caecidotea kendeighi</i>	Springs				
AMPHIPODA (Amphipods)					
Crangonyctidae					
<i>Batrurur mucronatus</i>	Springs				
<i>Crangonyx gracilis</i>			X	X	
Gammaridae					
<i>Gammarus pseudolimnaeus</i> #	X				
Hyalellidae					
<i>Hyalella azteca</i> #	X	X	X	X	
DECAPODA (Crayfishes & shrimps)					
Palaemonidae					
<i>Palaemonetes</i>					
<i>kadiakensis</i> Mississippi grass shrimp			X	X	
Cambaridae					
<i>Procambarus acutus</i> # White River crawfish			X	X	
<i>Procambarus gracilis</i> prairie crayfish			burrower		
<i>Orconectes immunis</i> # calico crayfish			X	X	
<i>Orconectes</i>					
<i>propinquus</i> clearwater crayfish	X				
<i>Orconectes rusticus</i> * rusty crayfish	X			X	
<i>Orconectes virilis</i> # virile crayfish	X	X		X	
<i>Cambarus diogenes</i> devil crawfish			burrower		

¹Data from the Illinois Natural History Survey Crustacean Collection.

²* = non-native species; # = common species.

³Total number of species = 14 (13 native, 1 introduced).

Table 23. Aquatic macroinvertebrates, exclusive of the Crustacea and unionoidean Mollusca, recorded from the Illinois River Bluffs Assessment Area.¹

Phylum NEMATODA - Nematode Worms

Phylum NEMATOMORPHA - Horsehair Worms

Gordiidae
Gordius sp.
Paragordius sp.

Phylum TURBELLARIA - Flatworms

Tricladida
 Planariidae
Dugesia tigrina

Phylum ANNELIDA - Segmented Worms

Class APHANONEURA
- Suction-Feeding Worms
Aeolosomatida
 Aeolosomatidae
Aeolosoma sp.

Class BRANCHIOBELLEAE - Crayfish
Worms
Branchiobdellida
 Cambarincolidae
 Genus *Cambarincola* sp.

Class OLIGOCHAETA - Oligochaete
Worms
Tubificida
 Enchytraeidae
 Naididae
Amphichaeta leydigi
Chaetogaster diaphanus
Chaetogaster diastrophus
Chaetogaster limnaei
Dero digitata
Dero nivea
Nais behningi
Nais bretscheri
Nais communis
Nais pardalis
Nais simplex
Nais variabilis
Ophidonais serpentina

Paranais frici
Pristina aequiseta
Pristina leidy
Pristinella osborni
Slavina appendiculata
Tubificidae
Aulodrilus pigueti
Branchiura sowerbyi
Ilyodrilus templetoni
Limnodrilus cervix
Limnodrilus hoffmeisteri
Tubifex tubifex
Lumbricidae
Eisenia foetida
Eiseniella tetraedra

Class HIRUDINEA - Leeches
Rhynchobdellida
 Glossiphoniidae
Placobdella papillifera
Pharyngobdellida
 Erpobdellidae
Erpobdella punctata

Phylum ARTHROPODA - Arthropods

Class INSECTA - Insects
Ephemeroptera - Mayflies
 Baetiscidae
Baetisca sp.
 Baetidae
Baetis sp.
Callibaetis fluctuans
 Caenidae
Caenis sp.
 Ephemeridae
Hexagenia atrocaudata
Hexagenia limbata
Pentagenia vittigera
 Heptageniidae
Heptagenia sp.
Stenacron interpunctatum
Stenonema terminatum
 Isonychiidae
Isonychia bicolor

Table 23. Continued

Potamanthidae

- Anthopotamus myops*
- Potamanthus* sp.

Odonata - Damselflies and Dragonflies

Zygoptera - Damselflies

Calopterygidae

- Calopteryx maculata*
- Hetaerina americana*

Coenagrionidae

- Amphiagrion mesonotum*
- Argia apicalis*
- Argia fumipennis violacea*
- Argia moesta*
- Argia tibialis*
- Enallagma antennatum*
- Enallagma basidens*
- Enallagma carunculatum*
- Enallagma civile*
- Enallagma exsulans*
- Enallagma signatum*
- Ischnura verticalis*

Lestidae

- Lestes rectangularis*

Anisoptera - Dragonflies

Aeshnidae

- Aeshna umbrosa*
- Anax junius*
- Boyeria vinosa*

Gomphidae

- Gomphus externus*
- Gomphus fraternus*
- Gomphus graslinellus*
- Gomphus spiniceps*
- Gomphus submedianus*
- Gomphus vastus*
- Hagenius brevistylus*
- Ophiogomphus rupinsulensis*

Corduliidae

- Neurocordulia obsoleta*
- Somatochlora* sp.

Macromiidae

- Didymops transversa*
- Macromia illinoiensis*
- Macromia pacifica*

Libellulidae

- Celithemis eponina*
- Erythemis simplicicollis*
- Libellula luctuosa*
- Libellula pulchella*
- Pachydiplax longipennis*
- Plathemis lydia*
- Pantala flavescens*
- Perithemis tenera*
- Sympetrum obtusum*
- Sympetrum vincinum*

Plecoptera - Stoneflies

Capniidae

- Allocaupnia granulata*
- Allocaupnia vivipara*

Perlidae

- Isoperla bilineata*
- Acroneuria abnormis*
- Attaneuria ruralis*
- Neoperla clymene* complex
- Perlستا decipiens* complex

Perlodidae

- Isoperla nana*

Taeniopterygidae

- Strophopteryx fasciata*
- Taeniopteryx burksi*

Pteronarcyidae

- Pteronarcys pictetii*

Heteroptera - True Bugs

Pleidae

- Neoplea striola*

Nepidae - Water Scorpions

- Nepa apiculata*
- Ranatra nigra*

Corixidae - Water Boatmen

- Hesperocorixa obliqua*
- Palmocorixa buenoi*
- Palmacorixa gillettei*
- Sigara alternata*
- Sigara grossolineata*
- Sigara modesta*
- Trichocorixa calva*
- Trichocorixa kanza*

Table 23. Continued

Notonectidae - Backswimmers	Hydrophilidae
<i>Buenoa scimitra</i>	<i>Berosus peregrinus</i>
<i>Notonecta raleighi</i>	<i>Cymbiodytia blanchardi</i>
<i>Notonecta undulata</i>	<i>Enochrus pygmaeus nebulosus</i>
Hebridae - Velvet Water Bugs	<i>Helophorus</i> sp.
<i>Merragata hebroides</i>	<i>Hydrobius fuscipes</i>
Mesoveliidae - Water Treaders	<i>Hydrochara obtusata</i>
<i>Mesovelia mulsanti</i>	<i>Hydrophilus triangularis</i>
Gerridae - Pond Skaters	<i>Laccobius agilis</i>
<i>Aquarius remigis</i>	<i>Paracymus communis</i>
<i>Gerris argenticollis</i>	<i>Paracymus subcupreus</i>
<i>Gerris incurvatus</i>	<i>Tropisternus ellipticus</i>
<i>Gerris marginatus</i>	<i>Tropisternus lateralis nimbatus</i>
<i>Metrobates hesperius</i>	<i>Tropisternus natator</i>
<i>Neogerris hesione</i>	Hydraenidae
<i>Rheumatobates tenuipes</i>	<i>Hydraena pennsylvanica</i>
<i>Trepobates subnitidus</i>	Scirtidae
Veliidae - Little Water Striders	<i>Cyphon</i> sp.
<i>Rhagovelia oriander</i>	
Belostomatidae - True Water Bugs	Trichoptera - Caddisflies
<i>Belostoma flumineum</i>	Hydropsychidae
<i>Lethocerus griseus</i>	<i>Ceratopsyche morosa</i>
	<i>Cheumatopsyche lasia</i>
Coleoptera - Beetles	<i>Cheumatopsyche pettiti</i>
Dryopidae	<i>Hydropsyche cuanis</i>
<i>Helicus lithophilus</i>	<i>Hydropsyche orris</i>
<i>Helicus striatus</i>	<i>Potamyia flava</i>
Dytiscidae	Hydroptilidae
<i>Agabus</i> sp.	<i>Hydroptila angusta</i>
<i>Copelatus glypticus</i>	Leptoceridae
<i>Hydroporus consimilis</i>	<i>Ceraclea transversus</i>
<i>Laccophilus fasciatus</i>	<i>Leptocerus americanus</i>
<i>Laccophilus maculosus</i>	<i>Oecetis cinerascens</i>
<i>Laccophilus proximus</i>	<i>Oecetis inconspicua</i>
Elmidae	<i>Nectopsyche candida</i>
<i>Dubiraphia minuta</i>	<i>Nectopsyche diarina</i>
<i>Dubiraphia quadrinotata</i>	Rhyacophilidae
<i>Macronychus glabratus</i>	<i>Rhyacophila fenestra</i>
<i>Stenelmis vittipennis</i>	
Gyrinidae	Diptera - Flies
<i>Dineutus assimilus</i>	Tipulidae
Haliplidae	<i>Erioptera</i> sp.
<i>Peltodytes edentulus</i>	<i>Limonia</i> sp.
<i>Peltodytes sexmaculatus</i>	<i>Tipula</i> sp.
<i>Haliplus borealis</i>	Chaoboridae
	<i>Chaoborus punctipennis</i>

Table 23. Continued

Culicidae	<i>Cricotopus trifasciatus</i>
<i>Anopheles</i> sp.	<i>Eukiefferiella</i> sp.
<i>Culex</i> sp.	<i>Hydrobaenus</i> sp.
Empididae	<i>Nanocladius</i> sp.
Ephydriidae	<i>Parakiefferiella</i> sp.
Psychodidae	<i>Parametrioctenemus</i> sp.
Stratiomyidae	<i>Thienemanniella</i> sp.
Ceratopogonidae	Tanypodinae
<i>Ceratopogon</i> sp.	Coelotanypodini
<i>Culicoides</i> sp.	<i>Coelotanypus</i> sp.
Simuliidae	Natarsiini
<i>Simulium</i> sp.	<i>Natarsia</i> sp.
Chironomidae	Procladiini
Chironominae	<i>Procladius</i> sp.
Chironomini	Pentaneurini
<i>Chironomus</i> sp.	<i>Ablabesmyia</i> sp.
<i>Cladopelma</i> sp.	<i>Labrundinia</i> sp.
<i>Cryptochironomus</i> sp.	<i>Larsia</i> sp.
<i>Dicrotendipes</i> sp.	<i>Thienemannimyia</i> sp.
<i>Endochironomus</i> sp.	Tanypodini
<i>Endochironomus nigricans</i>	<i>Tanypus</i> sp.
<i>Glyptotendipes</i> sp.	Tabanidae
<i>Microtendipes</i> sp.	<i>Chrysops aberrans</i>
<i>Parachironomus frequens</i>	<i>Chrysops callidus</i>
<i>Psilometrioctenemis triannulatus</i>	<i>Chrysops niger</i>
<i>Polypedilum</i> sp.	<i>Chrysops pikei</i>
<i>Stenochironomus</i> sp.	<i>Chrysops sequax</i>
<i>Stictochironomus</i> sp.	<i>Chrysops univittatus</i>
<i>Tribelos</i> sp.	<i>Chrysops vittatus</i>
Pseudochironomini	<i>Tabanus atratus</i>
<i>Pseudochironomus</i> sp.	<i>Tabanus lineola</i>
Tanytarsini	<i>Tabanus pumilus</i>
<i>Cladotanytarsus</i> sp.	<i>Tabanus quinquevittatus</i>
<i>Paratanytarsus</i> sp.	<i>Tabanus reinwardtii</i>
<i>Rheotanytarsus</i> sp.	<i>Tabanus sackeni</i>
<i>Tanytarsus</i> sp.	<i>Tabanus similis</i>
Orthocladiinae	<i>Tabanus subsimilis</i>
<i>Brillia</i> sp.	<i>Tabanus trimaculatus</i>
<i>Bryophaenocladius</i> sp.	
<i>Corynoneura</i> sp.	
<i>Cricotopus</i> / <i>Orthocladius</i> complex	
<i>Cricotopus anulator</i>	
<i>Cricotopus bicinctus</i>	
<i>Cricotopus infuscatus</i>	
<i>Cricotopus intersectus</i>	
<i>Cricotopus ornatus</i>	
<i>Cricotopus sylvestris</i>	

Phylum MOLLUSCA - Mollusks

Gastropoda - Snails

- Ancylidae
- Ferrissia* sp.
- Hydrobiidae
- Limnaeidae
- Fossaria* sp.
- Stagnicola* sp.

Table 23. Continued

Physidae

Physa sp.

Physella sp.

Pelecypoda - Bivalve Mollusks

Sphaeriidae

Pisidium sp.

Sphaerium cf. *fable*

¹ Data are from the Illinois Natural History Survey Insect and Annelida collections, and literature cited in this document. List compiled by M. J. Wetzel and D. W. Webb, INHS Center for Biodiversity.

Threatened and Endangered Fishes

One state endangered fish, the weed shiner, is known historically from Peoria Lake and the Illinois River at Peoria. However, it was last observed in 1879 and is presumed to be extirpated from the region. The cisco, a state threatened species, was last observed in Lake Senachwine Lake near Putnam in 1935 and also is presumed to be extirpated.

The weed shiner is one of the rarest fishes in Illinois and is known to maintain populations only in the Kankakee River in Kankakee County, in upper Beaver Creek, a tributary of the Iroquois River in Kankakee and Iroquois counties, and at two localities in the Rock River drainage. The cisco once was found in lakes along the Illinois River but now occurs in Illinois only in Lake Michigan.

Threatened and Endangered Mussels

This region historically supported four state endangered or threatened mussels, one of which (Higgins eye) is also federally endangered (Tables 19 and 20). The Illinois River was surveyed for mussels at over 400 sites in 1966-67 (Starrett, 1971). Of the 47 species known to occur in the river, only 23 were collected live in 1967 and 1993-95 (Whitney et al. 1997). All of the species found by Starrett were relatively common in other rivers in Illinois and no state or federally listed species were found living. Although recent data suggest that the Illinois River is improving, only one live state threatened mussel (butterfly) has been collected since the 1920's (Whitney et al. 1997).

Historical records of the state threatened spike, ebonyshell, and butterfly are available for the Illinois River in this region. Of these species, Starrett (1971) found one live ebonyshell in his survey of the Illinois River. There are no recent records of these three species in the Illinois Bluffs Region.

The federally endangered Higgins eye was recorded from the Illinois River at Peoria in 1870. No live individuals have been collected in many years and it is presumed extirpated from the Illinois River.

Starrett (1971) regarded the scaleshell as doubtful in the Illinois River because he could not find any vouchers to confirm the published record of Baker (1906). A specimen labeled "Peoria, Illinois" presumably collected from the Illinois River is in the collection of the U.S. National Museum (#86054). No live individuals have been collected in many years and it is likely extirpated from the state.

Non-native Species

The common carp has been introduced to this region. It can be found in almost any type of habitat but prefers warm sluggish waters of streams and lakes and is very tolerant of high turbidity and low oxygen levels. Native to Eurasia, the common carp has been present in Illinois since the earliest surveys, making its effect on native species difficult to determine. The species tends to destroy vegetation and increase water turbidity by dislodging plants and rooting around in the substrate, causing a deterioration of habitat for species requiring vegetation and clear water. The species attains a large size and has become an important commercial food species in Illinois; however, it may have done so at the expense of ecologically similar native species such as carpsuckers and buffalos. It was distributed throughout Illinois by the time of Forbes and Richardson's (1908) survey of Illinois fishes and was described as abundant in all parts of the state by Smith (1979). It remains common in most areas of Illinois.

The goldfish also is a Eurasian carp that has been present in Illinois since at least the 1800's. It is sporadic in its distribution, but the largest population is that in the Illinois River. The goldfish does best in polluted streams where few other fishes are present; as the water quality of the Illinois River improves, the goldfish can be expected to become less common. The impacts of the goldfish on native fishes, like the impacts of the carp, are difficult to assess because of the long history of the species in Illinois; however, the goldfish must be less damaging because of its more restricted distribution and its inability to persist where native species do well.

Two exotic mussels are found in the IRBAA; the Asian clam and the zebra mussel. The Asian clam is found only in the Illinois River in this region. Effects of the Asian clam on native species and communities are difficult to measure, but the species probably competes with native mussels for food. The zebra mussel is found in the Illinois River. The zebra mussel is having negative impacts on many native Illinois species, particularly native mussels that are restricted to large rivers.

One exotic crustacean is also found in the IRBAA; the rusty crayfish. The rusty crayfish was first found in this region in 1974 and is rapidly expanding its range. This species is documented to have contributed to declines in native mussels and crayfishes in Illinois (Taylor and Redmer 1996).

Of the aquatic macroinvertebrate taxa known or thought likely to occur in the IRBAA, one aquatic worm species is thought to have been introduced. *Branchiura sowerbyi* (Annelida: Oligochaeta: Tubificidae) was first reported in the USA from a lake in Ohio in 1932, most likely introduced to the continent with imported aquatic and semiaquatic plants or other aquatic organisms. Originally thought to be restricted to thermally influenced habitats, *B. sowerbyi* is now commonly collected from a variety of stream and lake systems. This species is widespread throughout North America and Europe, and has been recorded from all continents except Antarctica. *Branchiura sowerbyi* does not appear to pose any threat to native populations of aquatic macroinvertebrates.

Information Gaps

The Illinois River has been fairly well studied with respect to fishes, crayfishes and mussels. However, additional survey work in the smaller tributaries would better define the limits of some of the species, especially mussels, and possibly uncover additional populations of the state endangered species.

Long-term population monitoring of selected species and communities is needed throughout the state to provide information on trends in biological resources and on the success of various management strategies. Mark-recapture studies also are badly needed to understand normal movements of fishes and other aquatic organisms and, hence, to provide baseline data for interpreting the impacts of environmental alterations and management strategies.

Major groups of aquatic macroinvertebrates known to occur in the IRBAA have not been well studied. Although historical and recent collections of aquatic macroinvertebrates from the IRBAA are deposited in the permanent INHS Collections, much of this information is not easily retrievable because either specimens have not yet been identified, or the identified material has not yet been incorporated into a searchable database.

Once specimens have been identified and incorporated into a database, comparisons of historical material with that obtained during more recent collections could be made to determine changes in distribution and abundance. Moreover, long-term monitoring of selected groups of aquatic macroinvertebrates in habitats throughout the state — particularly in headwater streams and, to a lesser extent, in small ponds, lakes, and wetland areas — would provide needed information on population trends and habitat associations.

Water Quality

The Illinois Water Quality Report (Illinois Environmental Protection Agency 1996) describes water quality conditions for designated uses including aquatic life, swimming, drinking water, recreation, secondary contact, and fish consumption based on a wide variety of biotic and abiotic monitoring programs. This report rated the entire Illinois

River as “Partial Support/Minor Impairment” (water quality has been impaired, but only to a minor degree). Nutrients and siltation attributed to agriculture were the cause of the partial use rating.

The Biological Stream Characterization (Bertrand et al. 1995) did not rate the Illinois River, but rated Sandy Creek, Bills Run, and Senachwine Creek, tributaries to the Illinois River, as “B” Streams.

Environmental Problems

Stream ecosystems are fragmented by landscape changes that render stream habitats unsuitable for aquatic organisms and by instream modifications that eliminate stream habitats. Smith (1971) ranked the causes of extirpation or declines in fish species in Illinois as follows: siltation (as the primary factor responsible for the loss of 2, and decimation of 14, species), drainage of bottomland lakes, swamps, and prairie marshes (0, 13), desiccation during drought (0, 12), species introductions (2, 7), pollution (2, 5), impoundments (0, 4), and increased water temperatures (0, 1). All of these factors render habitats unsuitable for many aquatic species throughout Illinois and lead to extirpations.

Streams in Illinois naturally have wooded floodplains that are extremely important in maintaining a healthy aquatic environment. The vegetation on a floodplain shades the stream and keeps it from becoming excessively hot during the summer, stabilizes the streambank and reduces erosion, and acts as a filter that removes topsoil and pesticides which would otherwise reach the stream as water drains from croplands. During periods of high water, vegetated floodplains provide feeding and spawning areas for many species of aquatic organisms and nurseries for developing larvae. When floodplains are converted to crop production as they have been throughout much of Illinois, they no longer provide these benefits to aquatic organisms.

Another major landscape change that has negatively impacted streams has been the tiling of land for agriculture. Land that once drained slowly drains quickly once it is tiled. Rapid drainage of land increases the pulse of a flood and increases the intensity and duration of low-flow once the water has moved downstream. These artificially extreme fluctuations in water levels subject stream organisms to environmental conditions to which they are not adapted and can lead to the extirpation of populations.

Siltation, increased water temperatures, and desiccation follow the removal of riparian vegetation and the tiling of fields as land is prepared for agriculture. The excessive siltation associated with the removal of floodplain vegetation is among the most damaging forms of stream pollution. The clean rock and gravel substrates that are normally characteristic of riffles and other stream habitats with fast-flowing water provide living space for many species of aquatic insects and other invertebrates and important spawning habitat for many species of fishes. The deposition of silt covers the rocks, leaving no place for small organisms to hide or for fishes to hide their eggs. Silt

can also cover the leaves of aquatic plants and, if sufficient to prevent gas exchange or photosynthesis, will cause the plants to die. The reduction of plant life in a stream has a cascading negative impact on the stream ecosystem. Many animals, in particular insect larvae and fishes, use the plants as places to hide and forage. Some fishes use plants to hide from predators, others use plants as sites from which to ambush prey. As plants are eliminated, populations of insects and fishes are reduced or eliminated because they have fewer places to live.

The impact of increased water temperatures resulting from the loss of riparian vegetation and reduced water flow during warm seasons is difficult to separate from the effects of siltation and other factors that occur concomitantly. However, throughout Illinois, increased water temperatures per se are probably especially harmful to cool-water species such as northern pike and species dependent on springs and spring-fed streams, such as the southern redbelly dace and many species of amphipods, isopods, and crayfishes.

Stream desiccation is thought to be primarily an effect of the artificially extreme fluctuations in water levels that follow tiling of fields for agriculture. The rapid drainage of surrounding land increases the intensity and prolongs the duration of low-flow once the water has moved downstream. A drought that historically would have had the impact of decreasing the flow in a stream can now lead to a dry stream bed.

Floodplains of large rivers normally have low areas that fill with water during floods and survive year-round as shallow lakes. These lakes provide primary habitat for a wide variety of plants and animals, and because they naturally have luxuriant plant growth, they are important feeding areas for waterfowl, and they provide spawning areas, nurseries for larvae, and overwintering refugia for fishes. Unfortunately, most of the bottomland lakes in Illinois have been drained to create cropland, and those that remain have become shallow and barren because of the tremendous silt loads deposited in them each year during periods of high water. The shallow muddy lakes no longer support the plant life that was fundamental to successful completion of the life cycles of many aquatic species.

The impacts of introduced fishes include competition, predation, inhibition of reproduction, environmental modification, transfer of parasites and diseases, and hybridization. Freshwater mussels and crayfishes have been seriously impacted in Illinois in recent decades by non-native invaders, most notably the zebra mussel and the rusty crayfish. Nalepa (1994) documented the severe decline in native mussels due to the invasion of zebra mussels in Lake St. Clair over a six-year period. He found that mussel densities declined from 2.4/m² in 1986 to 0/m² in 1992 in areas heavily infested with zebra mussels. The rusty crayfish, introduced through its use as fishing bait, is rapidly spreading through Illinois and displacing native crayfishes (Taylor and Redmer 1996).

Point sources of pollution include industrial wastes and domestic sewage. In Illinois, considerable progress has been made in identifying and eliminating point sources of pollution, and water quality has improved as a result. Nonpoint sources are now a larger

problem than are point sources and include siltation and agricultural pesticides that reach streams following the removal of floodplain vegetation.

Impounding a stream converts it into a standing body of water that lacks the riffles, runs, pools, and other habitats that stream-inhabiting organisms require. When a stream is dammed, most native species are eliminated from the inundated area, and upstream and downstream populations become isolated from one another. Dams block migrations of fishes that in many species are necessary for reproduction. The loss of migratory fishes from a stream ecosystem can lead to the loss of mussels using the migratory fishes as glochidial hosts. Between 1920-1940 forty-one drainage and levee districts were developed and six dams were built on the Illinois River. These slowed the flow of water, increased flooding, and destroyed many of the backwaters in the Lower River. By 1938 the large scale changes of the Illinois River and the valley were complete (Havera and Bellrose, 1985).

Channelization is the straightening of a stream to enhance drainage of the surrounding land. The straightening converts the diversity of habitats in a stream to one continuous straight channel that supports few species. Because of their sedentary nature mussels are particularly susceptible to the effects of channelization.

Potential Management Strategies for Aquatic Species

Management strategies for aquatic ecosystems must consider each watershed on an individual basis. Attempting to correct problems locally without consideration of upstream activities and downstream implications will result in partial, and probably temporary, improvement.

Correction of some factors that have led to stream habitat fragmentation in past decades is relatively easy. Important initiatives include building sewage treatment plants and avoiding the construction of mainstream impoundments when possible. Other initiatives, such as stopping the removal of riparian vegetation, cessation of stream channelization and the drainage of bottomland lakes, require more public education and governmental action including, perhaps providing better incentives to landowners. Assuming that pollution will be held at current levels or reduced, nothing will be more beneficial to the biota of Illinois streams than to have natural riparian vegetation restored. Siltation, desiccation, and higher than normal temperatures would all be reduced to acceptable levels if streams were lined with native plants that shaded the stream, stabilized the banks, and filtered sediment and chemicals from runoff before they reached the stream.

Most introductions of non-native fishes have been done in an effort to improve sport or commercial fishing, and usually governmental agencies have been responsible for the introductions. We now know that non-native species alter ecosystems, and the long-term effect of any introduction is likely to be negative rather than an improvement.

Given the opportunity, streams will restore themselves and, often, the best approach to restoration may be to encourage restoration of the native vegetation of the drainage basin, in particular the riparian zone, correct any additional existing pollution problems, and let the stream return to natural conditions. In some instances additional measures, such as reintroducing extirpated species, may be advisable.

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Appendix 1

Incomplete list of vascular plants known to presently occur, to have recently occurred, or likely to occur in the IRBAA; species sorted by common name, with notes on their habitat associations.¹

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Flood-plain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
alder buckthorn-SE	<i>Rhamnus alnifolia-SE</i>							x	x			
alfalfa*	<i>Medicago sativa*</i>											x
Allegheny shadblow	<i>Amelanchier laevis</i>	x										
alsike clover*	<i>Trifolium hybridum*</i>											x
alternate-leaved dogwood	<i>Cornus alternifolia</i>	x							x			
American bindweed	<i>Calystegia sepium</i>	x	x	x			x					x
American black currant	<i>Ribes americanum</i>	x	x				x	x	x	x		
American chestnut	<i>Castanea dentata</i>	extirpated										
American elm	<i>Ulmus americana</i>	x	x									
American hop	<i>Humulus lupulus</i>		x									x
American lotus	<i>Nelumbo lutea</i>										x	
American pennyroyal	<i>Hedeoma pulegioides</i>	x										x
American spikenard	<i>Aralia racemosa</i>	x					x					
American water meal	<i>Wolfia columbiana</i>										x	
Amur honeysuckle*	<i>Lonicera maackii*</i>	x	x									x
annual bedstraw	<i>Galium aparine</i>	x										x
annual fleabane	<i>Erigeron annuus</i>	x				x						x
apple-of-Peru*	<i>Nicandra physalodes*</i>	x										x
aromatic aster	<i>Aster oblongifolius</i>				x							
aromatic sumac	<i>Rhus aromatica</i>	x										
arrow arum	<i>Peltandra virginica</i>						x		x		x	
arrow-leaved aster	<i>Aster sagittifolius</i>	x										
arum-leaved arrowleaf	<i>Sagittaria cuneata</i>						x				x	
asparagus*	<i>Asparagus officinalis*</i>			x	x							x
Aunt Lucy	<i>Ellisia nyctelea</i>	x	x				x					x
autumn olive*	<i>Elaeagnus umbellata*</i>	x		x						x		x
autumn sedge	<i>Fimbristylis autumnalis</i>										x	x
awl-fruited oval sedge	<i>Carex tribuloides</i>	x					x					
awned graceful sedge	<i>Carex davisii</i>	x										
barnyard grass	<i>Echinochloa crusgalli</i>						x					x
basil bee balm	<i>Monarda clinopodia</i>	x	x									
basswood	<i>Tilia americana</i>	x										
bastard toadflax	<i>Comandra umbellata</i>			x	x	x						
beach wormwood	<i>Artemisia campestris</i>				x	x						
beak grass	<i>Diarrhena americana</i>	x										
beaked black snakeroot	<i>Sanicula trifoliata</i>	x			x							
beefsteak plant*	<i>Perilla frutescens*</i>		x									x
beginner's pondweed*	<i>Potamogeton crispus*</i>										x	
biennial gaura	<i>Gaura biennis</i>	x		x	x	x						x
big bluestem	<i>Andropogon gerardii</i>			x	x	x						x

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Flood-plain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
big tooth aspen	<i>Populus grandidentata</i>	x	x									
bird's-foot trefoil*	<i>Lotus corniculatus*</i>											x
bird's-foot violet	<i>Viola pedata</i>			x	x	x						
bitter cress	<i>Cardamine pensylvanica</i>		x				x					
bitternut hickory	<i>Carya cordiformis</i>	x										
bittersweet	<i>Celastrus scandens</i>	x	x			x						x
bittersweet nightshade*	<i>Solanum dulcamara*</i>	x										x
black ash	<i>Fraxinus nigra</i>		x				x		x			
black bindweed*	<i>Polygonum convolvulus*</i>			x								x
black cherry	<i>Prunus serotina</i>	x	x			x						x
black grama	<i>Brachyelytrum erectum</i>	x										
black haw	<i>Viburnum prunifolium</i>	x										
black horehound*	<i>Ballota nigra*</i>											x
black locust*	<i>Robinia pseudoacacia*</i>	x										x
black maple	<i>Acer nigrum</i>	x	x									x
black medic*	<i>Medicago lupulina*</i>				x							x
black mustard*	<i>Brassica nigra*</i>											x
black nightshade	<i>Solanum ptycanthum</i>		x									x
black oak	<i>Quercus velutina</i>	x										
black raspberry	<i>Rubus occidentalis</i>	x			x					x		x
black snakeroot	<i>Sanicula canadensis</i>	x	x	x					x			
black swallow wort*	<i>Cynanchum nigrum*</i>											x
black walnut	<i>Juglans nigra</i>	x	x			x						x
black willow	<i>Salix nigra</i>		x				x		x			x
black-eyed Susan	<i>Rudbeckia hirta</i>	x		x		x						x
black-seeded rice grass -	<i>Oryzopsis racemosa- ST</i>	x										
blackberry lily*	<i>Belamcanda chinensis*</i>				x							
bladder catchfly*	<i>Silene cucubalus*</i>											x
bladdernut	<i>Staphylea trifolia</i>	x										
bloodroot	<i>Sanguinaria canadensis</i>	x										
blue ash	<i>Fraxinus quadrangulata</i>	x			x							
blue aster	<i>Aster anomalous</i>	x										
blue beech	<i>Carpinus caroliniana</i>	x	x									
blue cohosh	<i>Caulophyllum thalictroides</i>	x										
blue flag	<i>Iris virginicavar. shrevei</i>						x	x	x			
blue joint grass	<i>Calamagrostis canadensis</i>						x	x				x
blue lobelia	<i>Lobelia siphilitica</i>		x				x		x	x		
blue skullcap	<i>Scutellaria lateriflora</i>						x			x		x
blue star	<i>Amsonia tabernaemontana</i>	x							x			
blue vervain	<i>Verbena hastata</i>						x			x		x
blue vine	<i>Cynanchum laeve</i>		x									x
blunt-scaled oak sedge	<i>Carex artitecta</i>	x										
blunt-scaled wood sedge	<i>Carex albusina</i>	x										
bottlebrush grass	<i>Elymus hystrix</i>	x										
bottlebrush sedge	<i>Carex lurida</i>						x	x	x	x		
bouncing bet*	<i>Saponaria officinalis*</i>		x	x		x	x					x
box elder	<i>Acer negundo</i>	x	x									x
bracken fern	<i>Pteridium aquilinum var. latiusculum</i>	x				x						x
bracted plantain	<i>Plantago aristata</i>				x							x
bracted tick trefoil	<i>Desmodium cuspidatum</i>	x										x
bristle-stalked sedge	<i>Carex leptalea</i>							x				
bristly buttercup	<i>Ranunculus hispidus</i>	x	x									
bristly crowfoot	<i>Ranunculus pensylvanicus</i>		x				x					x

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Flood-plain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
bristly greenbrier	<i>Smilax hispida</i>	x	x		x	x						
bristly locust*	<i>Robinia hispida*</i>	x										x
bristly sedge	<i>Carex comosa</i>						x				x	
bristly sunflower	<i>Helianthus hirsutus</i>	x										x
broad-leaved panic grass	<i>Panicum latifolium</i>	x										
broad-leaved woolly sedge	<i>Carex pelliata</i>			x			x	x				
broadleaf goldenrod	<i>Solidago flexicaulis</i>	x										
brome grass	<i>Bromus pargans</i>	x										
brook flat sedge	<i>Cyperus rivularis</i>		x				x	x		x	x	
brook weed	<i>Samolus valerandii</i>		x									
brown fox sedge	<i>Carex vulpinoidea</i>		x	x			x	x				x
brown-eyed Susan	<i>Rudbeckia triloba</i>	x		x	x		x					x
buckbrush	<i>Symphoricarpos orbiculatus</i>	x										x
buffalo currant	<i>Ribes cynosbati</i>	x								x		x
buffalo grass	<i>Buchloe dactyloides</i>				x							x
bugle weed	<i>Lycopus virginicus</i>		x				x					
bull thistle*	<i>Cirsium vulgare*</i>											x
bur cucumber	<i>Sicyos angulatus</i>	x	x									x
bur oak	<i>Quercus macrocarpa</i>	x	x			x						x
bush honeysuckle	<i>Diervilla lonicera</i>	x										
butter-and-eggs*	<i>Linaria vulgaris*</i>											x
butterfly weed	<i>Asclepias tuberosa</i>			x	x		x					x
butternut	<i>Juglans cinerea</i>	x	x						x			
button bush	<i>Cephalanthus occidentalis</i>		x				x				x	
buttonbush dodder	<i>Cuscuta cephalanthi</i>		x				x					
buttonweed	<i>Diodia teres</i>											x
Canada blue grass*	<i>Poa compressa*</i>			x			x					x
Canada goldenrod	<i>Solidago canadensis</i>				x					x		
Canada thistle*	<i>Cirsium arvense*</i>											x
Canada wild rye	<i>Elymus canadensis</i>	x		x								
Canadian milk vetch	<i>Astragalus canadensis</i>			x	x							
canary grass*	<i>Phalaris canariensis*</i>											x
cardinal flower	<i>Lobelia cardinalis</i>		x								x	x
carpet weed*	<i>Mollugo verticillata*</i>		x									x
carrion flower	<i>Smilax pulverulenta</i>											
cat brier	<i>Smilax rotundifolia</i>	x										
cat's foot	<i>Antennaria neglecta</i>			x								
catnip*	<i>Nepeta cataria*</i>											x
celandine poppy	<i>Stylophorum diphyllum</i>	x										
celandine*	<i>Chelidonium majus*</i>		x									x
chairmaker's bulrush	<i>Scirpus pungens</i>		x					x				
cheat*	<i>Bromus secalinus*</i>											x
chicory*	<i>Cichorium intybus*</i>			x		x						x
Chinese cup grass*	<i>Eriochloa villosa*</i>		x									x
chinquapin oak	<i>Quercus muhlenbergii</i>	x										
chives*	<i>Allium schoenoprasum*</i>						x					x
Christmas fern	<i>Polystichum acrostichoides</i>	x										
cinnamon willow herb	<i>Epilobium coloratum</i>						x	x		x		
clammy ground cherry	<i>Physalis heterophylla</i>					x						x
clammy hedge hyssop	<i>Gratiola neglecta</i>		x								x	
clammyweed	<i>Polanisia dodecandra</i>		x									x
clearweed	<i>Pilea pumila</i>	x	x									x
climbing false buckwheat	<i>Polygonum scandens</i>	x	x									x
closed gentian	<i>Gentiana andrewsii</i>			x								

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Flood-plain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
cocklebur*	<i>Xanthium strumarium*</i>		x									x
cockspur thorn	<i>Crataegus crus-galli</i>	x										x
comb pondweed	<i>Potamogeton pectinatus</i>		x								x	
common arrowleaf	<i>Sagittaria latifolia</i>						x				x	
common beggar ticks	<i>Bidens frondosa</i>		x				x					
common beggar ticks	<i>Bidens vulgata</i>						x					x
common blackberry	<i>Rubus allegheniensis</i>	x										x
common blackberry	<i>Rubus pennsylvanicus</i>	x										x
common blue violet	<i>Viola pratincola</i>			x								
common blue-eyed grass	<i>Sisyrinchium albidum</i>			x	x	x						
common boneset	<i>Eupatorium perfoliatum</i>		x				x		x	x		x
common buckthorn*	<i>Rhamnus cathartica*</i>	x	x							x		x
common bur-reed	<i>Sparganium eurycarpum</i>						x		x			
common burdock*	<i>Arctium minus*</i>		x									x
common carrion flower	<i>Smilax lasioneuron</i>	x				x						
common cattail	<i>Typha latifolia</i>						x	x	x	x		x
common choke cherry	<i>Prunus virginiana</i>	x										
common cinquefoil	<i>Potentilla simplex</i>	x		x								x
common day flower*	<i>Commelina communis*</i>											x
common dodder	<i>Cuscuta gronovii</i>		x				x					
common evening primrose	<i>Oenothera biennis</i>			x	x	x				x		x
common fox sedge	<i>Carex stipata</i>		x				x	x				x
common foxtail	<i>Alopecurus carolinianus</i>											x
common gaura	<i>Gaura longiflora</i>	x		x	x							x
common goat's beard*	<i>Tragopogon pratensis*</i>											x
common hemp*	<i>Cannabis sativa*</i>											x
common horsetail	<i>Equisetum arvense</i>		x				x	x				x
common hound's tongue*	<i>Cynoglossum officinale*</i>											x
common ironweed	<i>Vernonia fasciculata</i>			x		x	x			x		x
common knotweed*	<i>Polygonum aviculare*</i>											x
common mallow*	<i>Malva neglecta*</i>											x
common milkweed	<i>Asclepias syriaca</i>			x			x					x
common mountain mint	<i>Pycnanthemum virginianum</i>			x		x						
common mullein*	<i>Verbascum thapsus*</i>											x
common oak sedge	<i>Carex pensylvanica</i>	x				x						
common orach*	<i>Atriplex patula*</i>											x
common peppergrass	<i>Lepidium virginicum</i>											x
common plantain*	<i>Plantago major*</i>											
common ragweed	<i>Ambrosia artemisiifolia</i>				x	x	x					x
common reed	<i>Phragmites australis</i>		x				x	x		x		x
common rockrose	<i>Helianthemum canadense</i>											
common satin grass	<i>Muhlenbergia frondosa</i>		x									x
common snakeroot	<i>Sanicula gregaria</i>	x										
common sow thistle*	<i>Sonchus uliginosus*</i>											x
common St. John's wort*	<i>Hypericum perforatum*</i>											x
common teasel*	<i>Dipsacus sylvestris*</i>			x								x
common water hemp	<i>Amaranthus rudis</i>		x					x				x
common water horehound	<i>Lycopus americanus</i>						x					
common whitlow grass	<i>Draba reptans</i>				x							
common wood sedge	<i>Carex blanda</i>	x	x	x								x
common yarrow*	<i>Achillea millefolium*</i>			x								x
compact dodder	<i>Cuscuta compacta</i>		x									
compass plant	<i>Silphium laciniatum</i>			x	x							
coontail	<i>Ceratophyllum demersum</i>											

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Flood-plain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
corn gromwell*	<i>Lithospermum arvense</i> *											x
corn speedwell*	<i>Veronica arvensis</i> *											x
cottonwood	<i>Populus deltoides</i>	x	x				x					x
cow parsnip	<i>Heracleum lanatum</i>	x	x									
crack willow*	<i>Salix fragilis</i> *		x									x
cream violet	<i>Viola striata</i>	x	x									
cream wild indigo	<i>Baptisia leucophaea</i>			x	x	x						
creeping Charlie*	<i>Glechoma hederacea</i> *		x									x
creeping love grass	<i>Eragrostis hypnoides</i>		x									
creeping primrose willow	<i>Ludwigia peploides</i> subsp. <i>glabrescens</i>		x				x				x	
creeping vervain	<i>Verbena bracteata</i>											x
creeping yellow cress*	<i>Rorippa sylvestris</i> *		x								x	x
crested oval sedge	<i>Carex cristatella</i>						x					x
crested rye grass*	<i>Lolium perenne</i> *											x
crowfoot grass*	<i>Eleusine indica</i> *		x									x
crown vetch*	<i>Coronilla varia</i> *			x								x
Culver's root	<i>Veronicastrum virginicum</i>	x		x		x						
cup plant	<i>Silphium perfoliatum</i>			x		x	x		x	x		x
curly dock*	<i>Rumex crispus</i> *	x					x					x
curly-styled wood sedge	<i>Carex rosea</i>	x										
cursed crowfoot	<i>Ranunculus sceleratus</i>						x	x	x			
cut-leaved teasel*	<i>Dipsacus laciniatus</i> *			x								x
cylindrical blazing star	<i>Liatris cylindracea</i>				x							
cypress spurge*	<i>Euphorbia cyparissias</i> *			x	x	x						x
daisy fleabane	<i>Erigeron strigosus</i>			x	x	x						
dame's rocket*	<i>Hesperis matronalis</i> *											x
dandelion*	<i>Taraxacum officinale</i> *											x
dark green bulrush	<i>Scirpus atrovirens</i>	x					x	x		x		x
declined trillium	<i>Trillium flexipes</i>	x										
decurent false aster-ST	<i>Boltonia decurrens</i> - ST		x				x					x
deer tongue grass	<i>Panicum clandestinum</i>	x	x							x		x
Deptford pink*	<i>Dianthus armeria</i> *	x										x
ditch stonecrop	<i>Penthorum sedoides</i>						x			x		x
dogfennel*	<i>Anthemis cotula</i> *											x
doll's eyes	<i>Actaea alba</i>	x							x			
dotted smartweed	<i>Polygonum punctatum</i>		x				x					x
downy arrowwood	<i>Viburnum rafinesquianum</i>	x										
downy brome*	<i>Bromus tectorum</i> *											x
downy gentian	<i>Gentiana puberulenta</i>			x								
downy sunflower	<i>Helianthus mollis</i>			x	x	x						
downy-blue violet	<i>Viola sororia</i>	x		x			x					
drooping coneflower	<i>Ratibida pinnata</i>	x		x	x							x
Drummond's aster	<i>Aster drummondii</i>				x							x
Dutchman's breeches	<i>Dicentra cucullaria</i>	x										
dwarf bindweed	<i>Calystegia spithamea</i>			x								
dwarf bulrush	<i>Hemicarpha micrantha</i>										x	
dwarf fleabane	<i>Conyza ramosissima</i>			x	x							x
dwarf larkspur	<i>Delphinium tricornis</i>	x										
dwarf plantain	<i>Plantago virginica</i>											x
early cudweed	<i>Gnaphalium purpureum</i>	x		x								x
early figwort	<i>Scrophularia lanceolata</i>	x										x
early goldenrod	<i>Solidago juncea</i>			x								x
early horse gentian	<i>Triosteum aurantiacum</i>	x										

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Flood-plain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
early meadow rue	<i>Thalictrum dioicum</i>	x										
eastern prickly pear	<i>Opuntia humifusa</i>			x								
ebony spleenwort	<i>Asplenium platyneuron</i>	x									x	
eelgrass	<i>Vallisneria spiralis</i>										x	
elderberry	<i>Sambucus canadensis</i>	x	x			x	x			x		
elm-leaved goldenrod	<i>Solidago ulmifolia</i>	x			x	x						
enchanter's nightshade	<i>Circaea lutetiana</i>	x	x						x			
English plantain*	<i>Plantago lanceolata</i> *					x						x
European highbush cranberry*	<i>Viburnum opulus</i> *	x							x			x
fall witch grass	<i>Leptoloma cognatum</i>			x								x
false aster	<i>Boltonia asteroides</i>		x				x				x	x
false boneset	<i>Brickellia eupatorioides</i>			x	x							x
false dandelion	<i>Krigia biflora</i>	x		x	x	x						
false dragonhead	<i>Physostegia virginiana</i>		x	x			x		x			
false foxglove	<i>Agalinis purpurea</i>						x				x	
false indigo bush	<i>Amorpha fruticosa</i>		x				x			x	x	
false mermaid	<i>Floerkea proserpinacoides</i>	x								x		
false nettle	<i>Boehmeria cylindrica</i>		x				x			x		x
false pennyroyal	<i>Isanthus brachiatum</i>			x	x							
false pimpernel	<i>Lindernia dubia</i>		x								x	
false rue anemone	<i>Isopyrum biternatum</i>	x										
false Solomon's seal	<i>Smilacina racemosa</i>	x										
false sunflower	<i>Heliopsis helianthoides</i>			x	x							x
fescue oval sedge	<i>Carex festucacea</i>			x		x						
few-flowered panic grass	<i>Panicum oligosanthos</i>			x	x							x
few-fruited gray sedge	<i>Carex oligocarpa</i>	x										
field bindweed*	<i>Convolvulus arvensis</i> *											x
field dodder	<i>Cuscuta campestris</i>		x				x					x
field garlic*	<i>Allium vineale</i> *											x
field goldenrod	<i>Solidago nemoralis</i>				x							x
field milkwort	<i>Polygala sanguinea</i>			x	x							x
field oval sedge	<i>Carex molesta</i>			x	x		x					x
field peppergrass*	<i>Lepidium campestre</i> *				x							x
field sorrel*	<i>Rumex acetosella</i> *			x	x	x						x
fireweed	<i>Erechtites hieracifolia</i>						x		x			
flat-topped aster	<i>Aster umbellatus</i>						x	x		x		
flower-of-an-hour*	<i>Hibiscus trionum</i> *											x
flowering almond*	<i>Prunus triloba</i> *			x		x						
flowering dogwood	<i>Cornus florida</i>	x										
flowering spurge	<i>Euphorbia corollata</i>			x	x	x						
foetid marigold*	<i>Dyssodia papposa</i> *											x
fog-fruit	<i>Phyla lanceolata</i>						x		x			x
forked aster-ST	<i>Aster furcatus-ST</i>	x										
fowl manna grass	<i>Glyceria striata</i>		x					x	x	x	x	x
foxglove beard-tongue	<i>Penstemon digitalis</i>			x		x						
foxtail mint*	<i>Mentha alopecuroides</i> *											x
fragile fern	<i>Cystopteris protrusa</i>	x										
fragrant ladies' tresses	<i>Spiranthes magnicamporum</i>				x							
French grass	<i>Psoralea tenuifolia</i>				x							
fringed loosestrife	<i>Lysimachia ciliata</i>		x	x			x		x	x		
fringed puccoon	<i>Lithospermum incisum</i>				x							
frost grape	<i>Vitis vulpina</i>	x	x		x	x						x
frosted hawthorn	<i>Crataegus pruinosa</i>	x	x									

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Flood-plain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
frostweed	<i>Helianthemum bicknellii</i>	x			x	x						
galingale	<i>Cyperus aristatus</i>		x								x	
garden loosestrife*	<i>Lysimachia vulgaris*</i>		x				x					x
garden phlox*	<i>Phlox paniculata*</i>	x										x
garden sunflower*	<i>Helianthus annuus*</i>											x
garlic mustard*	<i>Alliaria petiolata*</i>	x	x									x
germander	<i>Teucrium canadense</i>	x	x			x	x					x
giant foxtail*	<i>Setaria faberi*</i>											x
giant green foxtail	<i>Setaria viridis*</i>		x									x
giant ragweed	<i>Ambrosia trifida</i>				x	x						x
ginseng	<i>Panax quinquefolius</i>	x										
glade mallow	<i>Napaea dioica</i>		x				x					
glaucous campion*	<i>Silene cserei*</i>											x
glaucous white lettuce	<i>Prenanthes racemosa</i>			x								
glaucous tick trefoil	<i>Desmodium laevigatum</i>	x										
glossy buckthorn*	<i>Rhamnus frangula*</i>						x					
goat's-beard	<i>Aruncus dioicus</i>	x	x									
golded-seeded spike rush	<i>Eleocharis elliptica</i>			x			x	x			x	
golden Alexander's	<i>Zizia aurea</i>	x		x	x							
golden aster	<i>Heterotheca camporum</i>			x	x							
golden dock	<i>Rumex maritimus</i>									x	x	
goldenglow	<i>Rudbeckia laciniata</i>								x	x		x
goldenseal	<i>Hydrastis canadensis</i>	x										
goosefoot	<i>Chenopodium missouriense</i>		x									x
goosefoot	<i>Chenopodium standleyanum</i>	x	x									x
grape honeysuckle	<i>Lonicera prolifera</i>	x										
grass sedge	<i>Carex jamesii</i>	x					x					
grass-leaved goldenrod	<i>Euthamia gymnospermoides</i>			x								x
grass-of-Parnassus	<i>Parnassia glauca</i>						x	x	x	x		
gray dogwood	<i>Cornus racemosa</i>	x		x	x	x						
great angelica	<i>Angelica atropurpurea</i>							x	x			x
great bulrush	<i>Scirpus validus</i>		x				x					x
great duckweed	<i>Spirodela polyrhiza</i>										x	
great water dock	<i>Rumex orbiculatus</i>						x	x				
great waterleaf	<i>Hydrophyllum appendiculatum</i>	x	x								x	
green ash	<i>Fraxinus pennsylvanica</i>		x				x					
green dragon	<i>Arisaema dracontium</i>	x	x			x						
green milkweed	<i>Asclepias viridiflora</i>			x	x							
green orchid	<i>Platanthera hyperborea</i> var. <i>huronensis</i>						x			x		
green pigweed	<i>Amaranthus hybridus</i>		x									x
green violet	<i>Hybanthus concolor</i>	x										
green-headed fox sedge	<i>Carex conjuncta</i>		x	x								x
groundnut	<i>Apios americana</i>		x				x			x		
gumweed	<i>Grindelia squarrosa</i>				x							
hackberry	<i>Celtis occidentalis</i>	x	x							x		x
hair grass	<i>Agrostis hyemalis</i>		x									x
hairy aster	<i>Aster pilosus</i>			x	x							
hairy bedstraw	<i>Galium pilosum</i>	x	x		x							
hairy brome*	<i>Bromus commutatus*</i>				x							x
hairy crab grass*	<i>Digitaria sanguinalis*</i>											x
hairy green sedge	<i>Carex hirsutella</i>	x										
hairy hawkweed	<i>Hieracium longipilum</i>	x		x								x

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Flood-plain	Prairie	Hill		Marsh	Fen	sedge meadow	Seep	Pond/lake	
hairy mountain mint	<i>Pycnanthemum pilosum</i>				x							
hairy puccoon	<i>Lithospermum carolinense</i>			x	x							
hairy sweet cicely	<i>Osmorhiza claytonii</i>	x										
hairy wood sedge	<i>Carex hirtiflora</i>					x						
halberd-leaved rose mallow	<i>Hibiscus laevis</i>		x				x				x	
hard-stemmed bulrush	<i>Scirpus acutus</i>						x					
hazel dodder	<i>Cuscuta coryli</i>	x		x								x
hazelnut	<i>Corylus americana</i>	x		x		x						x
heart-leaved aster	<i>Aster cordifolius</i>	x										
heart-leaved skullcap	<i>Scutellaria ovata</i> var. <i>ovata</i>	x										
heart-leaved skullcap	<i>Scutellaria ovata</i> var. <i>versicolor</i>	x										
heart-leaved willow	<i>Salix eriocephala</i>		x				x					x
heath aster	<i>Aster ericoides</i>			x	x							x
hedge mustard*	<i>Sisymbrium officinale</i> *		x									x
henbit*	<i>Lamium amplexicaule</i> *											
highbush cranberry	<i>Viburnum trilobum</i>	x						x				
Hill's thistle-ST	<i>Cirsium hillii</i> -ST			x	x							
hoary cress*	<i>Cardaria draba</i> *											x
hoary puccoon	<i>Lithospermum canescens</i>			x	x							
hoary tick trefoil	<i>Desmodium canescens</i>	x				x	x					
hoary vervain	<i>Verbena stricta</i>			x	x	x						x
Hoary willow	<i>Salix candida</i>							x				
hog peanut	<i>Amphicarpaea bracteata</i>	x					x		x			
hollow Joe-Pye weed	<i>Eupatorium fistulosum</i>		x				x				x	
hollyhock*	<i>Alcea rosea</i> *											x
honewort	<i>Cryptotaenia canadensis</i>	x	x						x			
honey locust	<i>Gleditsia triacanthos</i>	x	x									x
hooded ladies' tresses	<i>Spiranthes romanzoffiana</i>	extirpated										
hooked buttercup	<i>Ranunculus recurvatus</i>						x	x	x			
hop hornbeam	<i>Ostrya virginiana</i>	x										
horse radish*	<i>Armoracia rusticana</i> *											x
horse-nettle*	<i>Solanum carolinense</i> *						x					x
horsetail milkweed	<i>Asclepias verticillata</i>				x	x						x
horseweed	<i>Conyza canadensis</i>			x	x							x
hybrid dogbane	<i>Apocynum X medium</i>	x	x	x								
hybrid grass	<i>Elyhordeum X montanense</i>	x		x								x
hybrid oak	<i>Quercus x runcinata</i>	x										
hybrid woodfern	<i>Dryopteris x triploidea</i>	x										
Illinois bundle flower	<i>Desmanthus illinoense</i>		x	x	x	x	x			x		
Illinois carrion flower	<i>Smilax illinoensis</i>	x										
Illinois tick trefoil	<i>Desmodium illinoense</i>			x								x
Indian grass	<i>Sorghastrum nutans</i>			x	x	x						
Indian hemp	<i>Apocynum cannabinum</i>	x	x	x			x			x		x
Indian mustard*	<i>Brassica juncea</i> *											x
Indian paintbrush	<i>Castilleja coccinea</i>				x	x						
Indian pipe	<i>Monotropa uniflora</i>	x										x
Indian tobacco	<i>Lobelia inflata</i>	x										
inland rush	<i>Juncus interior</i>			x	x		x				x	
intermediate scouring rush	<i>Equisetum X ferrissii</i>		x	x								
Iowa crabapple	<i>Malus ioensis</i>	x			x							
ivy-leaved duckweed	<i>Lemna trisulca</i>							x		x	x	
ivy-leaved morning glory*	<i>Ipomoea hederacea</i> *											x
Jack-in-the-pulpit	<i>Arisaema triphyllum</i>	x										

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Flood plain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
Jacob's ladder	<i>Polemonium reptans</i>	x	x			x						
Japanese chess*	<i>Bromus japonicus</i> *											x
Japanese hop*	<i>Humulus japonicus</i> *	x										x
Japanese knotweed*	<i>Polygonum cuspidatum</i> *						x					x
Jerusalem artichoke	<i>Helianthus tuberosus</i>		x				x					x
Jimsonweed*	<i>Datura stramonium</i> *		x									
Johnson grass*	<i>Sorghum halepense</i> *											x
jointed goat grass*	<i>Aegilops cylindrica</i> *											x
June grass	<i>Koeleria macrantha</i>			x	x	x						
Kentucky blue grass*	<i>Poa pratensis</i> *	x		x	x							x
Kentucky coffeetree	<i>Gymnocladus dioica</i>	x	x									
Kentucky wisteria* in IRBAA	<i>Wisteria frutescens</i> *	x										
lace grass	<i>Eragrostis capillaris</i>	x	x									x
lady fern	<i>Athyrium filix-femina</i>	x										
lady's thumb*	<i>Polygonum persicaria</i> *						x				x	x
lamb's quarters*	<i>Chenopodium album</i> *											x
lamb's quarters*	<i>Chenopodium berlandieri</i> *											x
lance-leaved buckthorn	<i>Rhamnus lanceolata</i>	x	x		x							
lance-leaved ground cherry	<i>Physalis virginiana</i>			x	x							x
lance-leaved loosestrife	<i>Lysimachia lanceolata</i>			x	x							
large lady's slipper	<i>Cypripedium calceolus</i> var. <i>pubescens</i>	x										
large twayblade orchid	<i>Liparis liliifolia</i>	x	x									
large-flowered water plantain	<i>Alisma plantago-aquatica</i> var. <i>americana</i>						x					
large-seeded mercury-ST	<i>Acalypha deamii</i> - ST		x									
late boneset	<i>Eupatorium serotinum</i>		x				x					x
late coral root	<i>Corallorrhiza odontorhiza</i>	x										
late figwort	<i>Scrophularia marilandica</i>	x	x			x				x		x
late goldenrod	<i>Solidago gigantea</i>	x	x									x
late horse gentian	<i>Triosteum perfoliatum</i>	x		x	x	x						
leadplant	<i>Amorpha canescens</i>	x		x	x							
leafcup	<i>Polymnia canadensis</i>	x					x		x	x		
leafy pondweed	<i>Potamogeton foliosus</i>										x	
leather flower	<i>Clematis pitcheri</i>	x	x									
leatherwood	<i>Dirca palustris</i>	x										
lesser twayblade orchid	<i>Liparis loeselii</i>	x		x			x	x	x			
lion's foot	<i>Prenanthes alba</i>	x										
little barley*	<i>Hordeum pusillum</i> *											x
little blue stem	<i>Schizachyrium scoparium</i>			x	x	x						x
liver-forever*	<i>Sedum purpureum</i> *					x						x
liverleaf	<i>Hepatica nobilis</i> var. <i>acuta</i>	x										
lizard's tail	<i>Saururus cernuus</i>		x				x		x			
long-awned bracted sedge	<i>Carex gravida</i>			x		x						x
long-fruited oval sedge	<i>Carex albolutescens</i>	x	x									
long-leaved ammania	<i>Ammannia coccinea</i>						x				x	
long-leaved pondweed	<i>Potamogeton nodosus</i>										x	
long-scaled green sedge	<i>Carex bushii</i>	x		x			x					x
loose-headed bracted sedge	<i>Carex sparganioides</i>	x	x									x
lopseed	<i>Phryma leptostachya</i>	x										
lousewort	<i>Pedicularis canadensis</i>			x								
low hop clover*	<i>Trifolium campestre</i> *											x
low love grass*	<i>Eragrostis poaeoides</i> *											x

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Flood-plain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
low love grass*	<i>Eragrostis minor</i> *		x									x
maidenhair fern	<i>Adiantum pedatum</i>	x										
maple-leaved goosefoot	<i>Chenopodium gigantospermum</i>	x										x
marbleseed	<i>Onosmodium occidentale</i>			x	x							
marsh bellflower	<i>Campanula aparinoides</i>						x	x	x			
marsh blazing star	<i>Liatris spicata</i>			x								
marsh bluegrass	<i>Poa palustris</i>						x					x
marsh club moss	<i>Selaginella eclipes</i>							x				
marsh fern	<i>Thelypteris palustris</i>						x	x				
marsh fleabane	<i>Erigeron philadelphicus</i>			x	x		x					x
marsh hedge nettle	<i>Stachys hispida</i>		x				x					x
marsh horsetail	<i>Equisetum palustre-extirpated</i>						x					x
marsh marigold	<i>Caltha palustris</i>						x	x	x	x		
marsh purslane	<i>Ludwigia palustris</i> var. <i>americana</i>		x				x				x	
marsh skullcap	<i>Scutellaria galericulata</i>						x					
marsh yellow cress	<i>Rorippa islandica</i> var. <i>feraldiana</i>						x		x	x		
Maryland senna	<i>Senna marilandica</i>				x							
mat panic grass	<i>Panicum leucothrix</i>				x							
mayapple	<i>Podophyllum peltatum</i>	x	x									
Mead's stiff sedge	<i>Carex meadii</i>			x	x	x						
meadow anemone	<i>Anemone canadensis</i>			x	x							
meadow parsnip	<i>Oxypolis rigidior</i>			x			x	x		x		
meadow rose	<i>Rosa blanda</i>	x										x
meadow sweet	<i>Spiraea alba</i>			x								
Mexican tea*	<i>Chenopodium ambrosioides</i> *											x
mild water pepper	<i>Polygonum hydropiperoides</i>		x				x				x	
milk spurge	<i>Chamaesyce humistrata</i>		x									x
milk spurge	<i>Chamaesyce supina</i>											x
Missouri goldenrod	<i>Solidago missouriensis</i>	x		x								x
Missouri gooseberry	<i>Ribes odoratum</i>	x	x									
Missouri gourd	<i>Cucurbita foetidissima</i>											x
Missouri ironweed	<i>Vernonia missurica</i>			x								
mitrewort	<i>Mitella diphylla</i>	x										
mockernut hickory	<i>Carya tomentosa</i>	x										
moneywort*	<i>Lysimachia nummularia</i> *		x	x								x
monkey flower	<i>Mimulus ringens</i>						x				x	x
moonseed	<i>Menispermum canadense</i>	x	x									
moth mullein*	<i>Verbascum blattaria</i> *											x
motherwort*	<i>Leonurus cardiaca</i> *	x	x									x
mouse-eared chickweed*	<i>Cerastium vulgatum</i> *											x
mullein foxglove	<i>Dasistoma macrophylla</i>	x	x		x							x
multiflora rose*	<i>Rosa multiflora</i> *	x	x	x								
musk thistle*	<i>Carduus nutans</i> *											x
nannyberry	<i>Viburnum lentago</i>	x	x					x	x			
narrow-leaved cattail	<i>Typha angustifolia</i>						x					x
narrow-leaved loosestrife	<i>Lysimachia quadriflora</i>			x			x		x			
narrow-leaved oval sedge	<i>Carex tenera</i>	x				x						
narrow-leaved spleenwort	<i>Diplazium pycnocarpon</i>	x										
narrow-leaved vervain	<i>Verbena simplex</i>			x								x
New England aster	<i>Aster novae-angliae</i>			x			x	x				x

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Flood-plain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
New Jersey tea	<i>Ceanothus americanus</i>	x		x		x						x
night-flowering catchfly*	<i>Silene noctiflora</i> *											x
nimblewill	<i>Muhlenbergia schreberi</i>	x										x
nipplewort*	<i>Lapsana communis</i> *											x
nodding beggar ticks	<i>Bidens cernua</i>						x				x	
nodding chickweed	<i>Cerastium nutans</i>											x
nodding fescue	<i>Festuca obiusa</i>	x										
nodding ladies' tresses	<i>Spiranthes cernua</i>			x								
nodding spurge	<i>Chamaesyce maculata</i>		x									x
nodding trillium	<i>Trillium cernuum</i> var. <i>macranthum</i>	x										
northern bugle weed	<i>Lycopus uniflorus</i>			x			x	x				
northern catalpa	<i>Catalpa speciosa</i>		x									x
northern willow herb	<i>Epilobium ciliatum</i>						x			x		
nut grass	<i>Cyperus esculentus</i>		x									x
oats*	<i>Avena sativa</i> *											x
obe-wan-conobea	<i>Leucospora multifida</i>		x				x					
Ohio buckeye	<i>Aesculus glabra</i>	x	x									
Ohio spiderwort	<i>Tradescantia ohiensis</i>	x		x	x	x						
old-field panic grass	<i>Panicum lanuginosum</i> var. <i>fasciculatum</i>	x		x								x
one-flowered broom rape	<i>Orobanche uniflora</i>	x										
Ontario aster	<i>Aster ontarionis</i>		x				x					
orange day lily*	<i>Hemerocallis fulva</i> *			x		x						x
orchard grass*	<i>Dactylis glomerata</i> *											x
Osage orange*	<i>Maclura pomifera</i> *	x			x							x
ox-eye daisy*	<i>Leucanthemum vulgare</i> *											x
pagoda plant	<i>Blephilia hirsuta</i>	x	x									
pale beard-tongue	<i>Penstemon pallidus</i>			x	x							
pale purple coneflower	<i>Echinacea pallida</i>			x	x							
pale corydalis	<i>Corydalis flavula</i>		x									x
pale dock	<i>Rumex altissimus</i>		x				x					x
pale dogwood	<i>Cornus obliqua</i>		x				x					
pale Indian plantain	<i>Cacalia atriplicifolia</i>	x		x		x						
pale sedge	<i>Carex granularis</i>	x	x					x				x
pale smartweed	<i>Polygonum lapathifolium</i>		x				x				x	x
pale sunflower	<i>Helianthus decapetalus</i>	x										
pale touch-me-not	<i>Impatiens pallida</i>	x								x		
pale-leaved sunflower	<i>Helianthus strumosus</i>	x										
panic grass	<i>Panicum meridionale</i>				x							
panicled aster	<i>Aster simplex</i>								x			
panicled tick trefoil	<i>Desmodium paniculatum</i>	x				x						
partridge pea	<i>Cassia fasciculata</i>		x	x		x						x
pasture rose	<i>Rosa carolina</i>	x		x	x	x						x
pasture thistle	<i>Cirsium discolor</i>			x		x						x
path rush	<i>Juncus tenuis</i>	x						x	x			x
paw paw	<i>Asimina triloba</i>	x	x									
peach-leaved willow	<i>Salix amygdaloides</i>		x				x				x	
pear*	<i>Pyrus communis</i> *	x										x
pecan	<i>Carya illinoensis</i>					x						
pellitory	<i>Parietaria pensylvanica</i>	x	x									x
penny cress*	<i>Thlaspi arvense</i> *											x
peppermint*	<i>Mentha x piperita</i> *						x			x		
persimmon	<i>Diospyros virginiana</i>	x										

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Flood-plain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
Peruvian daisy*	<i>Galinsoga quadriradiata</i> *											x
petioled willow	<i>Salix petiolaris</i>						x	x	x			
pickerel weed	<i>Pontederia cordata</i>										x	
pignut hickory	<i>Carya glabra</i>	x										
pin oak	<i>Quercus palustris</i>		x									
pineapple weed*	<i>Matricaria matricarioides</i> *											x
pinkweed	<i>Polygonum pensylvanicum</i>		x	x			x	x				x
plains oval sedge	<i>Carex brevior</i>	x		x		x						x
plains three-awn grass	<i>Aristida oligantha</i>											x
pointed tick trefoil	<i>Desmodium glutinosum</i>	x				x						
poison hemlock*	<i>Conium maculatum</i> *											x
poison ivy	<i>Toxicodendron radicans</i>	x	x			x						x
poison sumac	<i>Toxicodendron vernix</i>						x	x	x			
pokeweed	<i>Phytolacca americana</i>	x										x
poppy mallow	<i>Callirhoe triangulata</i>			x								x
porcupine grass	<i>Stipa spartea</i>			x	x							
porcupine sedge	<i>Carex hystricina</i>		x				x	x		x		
post oak	<i>Quercus stellata</i>	x										
poverty oat grass	<i>Danthonia spicata</i>	x				x						x
prairie alumroot	<i>Heuchera richardsonii</i>	x		x	x							
prairie blazing star	<i>Liatris pycnostachya</i>			x								
prairie blue-eyed grass	<i>Sisyrinchium campestre</i>			x								
prairie brome	<i>Bromus kalmii</i>		x					x				
prairie cinquefoil	<i>Potentilla arguta</i>	x		x	x	x						
prairie cord grass	<i>Spartina pectinata</i>			x			x					x
prairie coreopsis	<i>Coreopsis palmata</i>			x	x	x						
prairie dandelion - SE	<i>Microseris cuspidata</i> - SE											
prairie dock	<i>Silphium terebinthinaceum</i>			x								
prairie dodder	<i>Cuscuta pentagona</i>			x	x							
prairie dropseed	<i>Sporobolus heterolepis</i>			x	x							
prairie groundsel	<i>Senna hebecarpa</i>						x					
prairie Indian hemp	<i>Apocynum sibiricum</i>		x	x			x					x
prairie Indian plantain	<i>Cacalia plantaginea</i>			x								
prairie lily	<i>Lilium philadelphicum</i>			x								
prairie panic grass	<i>Panicum leibergii</i>			x	x							
prairie parsley	<i>Polytaenia nuttallii</i>				x	x						
prairie phlox	<i>Phlox pilosa</i>			x	x	x						
prairie ragwort	<i>Senecio obovatus</i>	x				x						
prairie rose	<i>Rosa setigera</i>	x		x						x		
prairie sedge	<i>Carex bicknellii</i>			x	x							
prairie sunflower	<i>Helianthus rigidus</i>			x	x							
prairie violet	<i>Viola pedatifida</i>			x	x							
prairie white fringed orchid-FT, SE	<i>Platanthera leucophaea</i>-FE, ST, extirpated			x								
prairie willow	<i>Salix humilis</i>			x								
prickly ash	<i>Zanthoxylum americanum</i>	x	x									
prickly gooseberry	<i>Ribes missouriense</i>	x										
prickly lettuce*	<i>Lactuca serriola</i> *											x
prickly sida*	<i>Sida spinosa</i> *											x
prostrate amaranth*	<i>Amaranthus graecizans</i> *											x
puncture vine*	<i>Tribulus terrestris</i> *											x
purple coneflower	<i>Echinacea purpurea</i>	x		x		x						
purple dead nettle*	<i>Lamium purpureum</i> *											x
purple giant hyssop	<i>Agastache scrophulariaefolia</i>	x	x									

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Flood-plain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
purple Joe-Pye-weed	<i>Eupatorium purpureum</i>	x				x						
purple loosestrife*	<i>Lythrum salicaria*</i>		x				x	x	x		x	x
purple love grass	<i>Eragrostis spectabilis</i>				x	x						x
purple meadow rue	<i>Thalictrum dasycarpum</i>	x				x						
purple milkweed	<i>Asclepias purpurascens</i>	x	x	x								x
purple oxalis	<i>Oxalis violacea</i>	x		x	x							x
purple prairie clover	<i>Dalea purpurea</i>			x	x							
purple rocket	<i>Isodanthus pinnatifidus</i>		x									
purple-stemmed tickseed	<i>Bidens connata</i>										x	
purple-top	<i>Tridens flavus</i>											x
purslane speedwell	<i>Veronica peregrina</i>											x
purslane*	<i>Portulaca oleracea*</i>											x
pussy toes	<i>Antennaria plantaginifolia</i>	x		x	x	x	x					
pussy willow	<i>Salix discolor</i>		x				x	x		x	x	
putty root orchid	<i>Aplectrum hyemale</i>	x										
quack grass*	<i>Agropyron repens*</i>											x
Queen Anne's lace*	<i>Daucus carota*</i>			x								x
Queen-of-the-prairie-ST	<i>Filipendula rubra- ST</i>						x	x	x			
ragged evening primrose	<i>Oenothera laciniosa</i>			x	x							x
rattlesnake fern	<i>Botrychium virginianum</i>	x										
rattlesnake master	<i>Eryngium yuccifolium</i>			x								
red bulrush	<i>Scirpus pendulus</i>			x			x					
red cedar	<i>Juniperus virginiana</i>	x			x							x
red clover*	<i>Trifolium pratense*</i>						x					x
red haw	<i>Crataegus mollis</i>	x	x									x
red morning glory*	<i>Ipomoea coccinea*</i>											x
red mulberry	<i>Morus rubra</i>	x	x									
red oak	<i>Quercus rubra</i>	x	x									
red trillium	<i>Trillium recurvatum</i>	x				x	x					
red-osier dogwood	<i>Cornus stolonifera</i>		x				x	x	x	x		
red-rooted sedge	<i>Cyperus erythrorhizos</i>		x								x	x
red-rooted spike rush	<i>Eleocharis erythropoda</i>						x				x	
red-seeded dandelion*	<i>Taraxacum laevigatum*</i>											x
red-stalked plantain	<i>Plantago rugelii</i>		x			x						x
redbud	<i>Cercis canadensis</i>	x										x
redtop*	<i>Agrostis alba*</i>		x					x	x			x
reed canary grass*	<i>Phalaris arundinacea*</i>						x	x	x	x	x	x
rice cutgrass	<i>Leersia oryzoides</i>						x	x	x		x	x
Riddell's goldenrod	<i>Solidago riddellii</i>			x								
rigid goldenrod	<i>Solidago rigida</i>			x	x							
river birch	<i>Betula nigra</i>		x									
river bulrush	<i>Scirpus fluvialis</i>						x				x	
river loosestrife	<i>Lysimachia hybrida</i>		x				x					
river sedge	<i>Carex lacustris</i>						x					
riverbank grape	<i>Vitis riparia</i>	x	x		x							x
riverbank wild rye	<i>Elymus riparius</i>		x									
Robin's plantain	<i>Erigeron pulchellus</i>		x									
rock jasmine	<i>Androsace occidentalis</i>				x							x
rock stain grass	<i>Muhlenbergia sobolifera</i>	x										
rosinweed	<i>Silphium integrifolium</i>			x	x							
rough avens	<i>Geum laciniatum</i>		x				x					x
rough blazing star	<i>Liatris aspera</i>			x	x							
rough cinquefoil	<i>Potentilla norvegica</i>		x	x								x
rough clustered sedge	<i>Carex cephaloidea</i>	x	x									

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Flood-plain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
rough dropseed	<i>Sporobolus aspera</i>				x							
rough false foxglove	<i>Agalinis aspera</i>				x							
rough hawkweed	<i>Hieracium scabrum</i>	x				x						
rough pennyroyal	<i>Hedeoma hispida</i>	x		x	x							x
rough pigweed	<i>Amaranthus retroflexus</i>											x
rough white lettuce	<i>Prenanthes aspera</i>			x								
rough-leaved dogwood	<i>Cornus drummondii</i>	x		x	x							x
rough-stemmed false foxglove	<i>Agalinis gattereri</i>				x							
round fruited St. John's-wort	<i>Hypericum sphaerocarpum</i>			x	x							x
round-headed bush clover	<i>Lespedeza capitata</i>			x	x	x						
round-leaved groundsel	<i>Senecio plattensis</i>			x								
rue anemone	<i>Anemella thalictroides</i>	x										
Russian olive*	<i>Elaeagnus angustifolia*</i>	x										x
rusty nut sedge	<i>Cyperus filiculmis</i>		x			x						x
rye*	<i>Secale cereale*</i>											x
salt-marsh cocksbur grass	<i>Echinochloa walteri</i>		x				x				x	
sand bracted sedge	<i>Carex muhlenbergii</i>				x							x
sand bur	<i>Cenchrus longispinus</i>											x
sand croton	<i>Croton glandulosus</i>											x
sand dropseed	<i>Sporobolus cryptandrus</i>			x								x
sand goat's beard*	<i>Tragopogon dubius*</i>											x
sand milkweed	<i>Asclepias amplexicaulis</i>			x	x							
sand primrose	<i>Oenothera rhombipetala</i>			x	x							
sandbar willow	<i>Salix exigua</i>										x	
sandbar willow	<i>Salix exigua</i>		x				x				x	
sandhill amaranth*	<i>Amaranthus arenicola*</i>											x
sassafras	<i>Sassafras albidum</i>	x			x							
saw-toothed sunflower	<i>Helianthus grosseserratus</i>			x	x							x
scarlet hawthorn	<i>Crataegus coccinea</i>	x										x
Schreber's aster-ST	<i>Aster schreberi- ST</i>	x					x					
scurf pea	<i>Psoralea onobrychis</i>			x	x	x						
self heal	<i>Prunella vulgaris</i>			x	x				x			x
seneca snakeroot	<i>Polygala senega</i>			x	x							
sensitive fern	<i>Onoclea sensibilis</i>	x					x					
sessile-flowered yellow cress	<i>Rorippa sessiliflora</i>										x	x
sessile-leaved tick trefoil	<i>Desmodium sessilifolium</i>				x	x						
shadbush	<i>Amelanchier arborea</i>	x										
shagbark hickory	<i>Carya ovata</i>	x				x						
shepherd's purse*	<i>Capsella bursa-pastoris*</i>											x
shingle oak	<i>Quercus imbricaria</i>	x				x						
shining bedstraw	<i>Galium concinnum</i>	x										
shining wedge grass	<i>Sphenopholis nitida</i>	x										
shooting star	<i>Dodecatheon meadia</i>	x		x	x							
Short's aster	<i>Aster shortii</i>	x										
Short's sedge	<i>Carex shortiana</i>	x	x	x								x
short-beaked arrowleaf	<i>Sagittaria brevirostra</i>						x					
short-headed bracted sedge	<i>Carex cephalophora</i>	x										
short-headed rush	<i>Juncus brachycephalus</i>		x	x	x		x					x
showy fly honeysuckle*	<i>Lonicera x bella*</i>	x										x
showy goldenrod	<i>Solidago speciosa</i>			x	x	x						
showy lady's slipper-SE	<i>Cypripedium reginae-SE</i>							x	x			
showy orchis	<i>Galearis spectabilis</i>	x										
showy tick trefoil	<i>Desmodium canadense</i>			x								

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Floodplain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
sickle pod	<i>Arabis canadensis</i>	x			x	x						
side-flowered aster	<i>Aster lateriflorus</i>	x	x				x					
side-oats grama	<i>Bouteloua curtipendula</i>			x	x							
silky aster	<i>Aster sericeus</i>				x							
silver maple	<i>Acer saccharinum</i>		x				x					
six weeks fescue	<i>Vulpia octoflora</i>											x
skunk cabbage	<i>Symplocarpus foetidus</i>		x					x	x	x		
sky-blue aster	<i>Aster azureus</i>	x			x	x						
sleepy catchfly	<i>Silene antirrhina</i>				x							x
slender bush clover	<i>Lespedeza virginica</i>	x		x	x							
slender corydalis	<i>Corydalis micrantha</i>	x										
slender false foxglove	<i>Agalinis tenuifolia</i>		x				x					
slender mountain mint	<i>Pycnanthemum tenuifolium</i>			x								
slender naiad	<i>Najas flexilis</i>										x	
slender sand sedge	<i>Cyperus ferruginescens</i>		x								x	x
slender wood sedge	<i>Carex gracilescens</i>	x				x						
slender-leaved panic grass	<i>Panicum linearifolium</i>	x			x							
slender-leaved pinweed	<i>Lechea tenuifolia</i>			x	x							
slippery elm	<i>Ulmus rubra</i>	x	x			x				x		
small cottonweed*	<i>Froelichia gracilis*</i>											x
small duckweed	<i>Lemna minor</i>						x				x	
small love grass	<i>Eragrostis pectinacea</i>										x	x
small peppergrass*	<i>Lepidium densiflorum*</i>											x
small pondweed	<i>Potamogeton pusillus</i>										x	
small skullcap	<i>Scutellaria parvula</i> var. <i>leonardii</i>				x							x
small snapdragon*	<i>Chaenorrhinum minus*</i>											x
small white morning glory	<i>Ipomoea lacunosa</i>		x									
small wood sunflower	<i>Helianthus microcephalus</i>	x										x
small wormseed mustard*	<i>Erysimum inconspicuum*</i>											x
small-flowered crowfoot	<i>Ranunculus abortivus</i>	x	x				x					x
small-flowered water plantain	<i>Alisma plantago-aquatica</i> var. <i>parviflorum</i>						x					
small-fruited false flax*	<i>Camelina microcarpa*</i>											x
smooth blue aster	<i>Aster laevis</i>			x			x					x
smooth brome*	<i>Bromus inermis*</i>											x
smooth crab grass*	<i>Digitaria ischaemum*</i>											x
smooth false foxglove	<i>Aureolaria flava</i>	x										
smooth hedge nettle	<i>Stachys tenuifolia</i>		x									
smooth mock orange*	<i>Philadelphus coronarius*</i>											x
smooth phlox	<i>Phlox glaberrima</i>			x			x					
smooth rock cress	<i>Arabis laevigata</i>	x										
smooth ruellia	<i>Ruellia strepens</i>		x									
smooth scouring rush	<i>Equisetum laevigatum</i>			x								x
smooth sumac	<i>Rhus glabra</i>	x		x	x	x				x		x
smooth sweet cicely	<i>Osmorhiza longistylis</i>	x										
sneezeweed	<i>Helenium autumnale</i>		x				x	x				
snow trillium	<i>Trillium nivale</i>	x										
snow-on-the-mountain*	<i>Euphorbia marginata*</i>											x
snowy campion	<i>Silene nivea</i>		x				x				x	
soft agrimony	<i>Agrimonia pubescens</i>	x										
soft leaved arrowwood - SE	<i>Viburnum molle - SE</i>											
Solomon's seal	<i>Polygonatum biflorum</i>	x				x	x					
southern catalpa	<i>Catalpa bignonioides</i>											x

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Floodplain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
southern naiad	<i>Najas guadalupensis</i>										x	
soybean*	<i>Glycine max*</i>											
Spanish needles	<i>Bidens bipinnata</i>											x
spear grass	<i>Poa chapmaniana</i>											x
spearmint*	<i>Mentha spicata*</i>											x
spike lobelia	<i>Lobelia spicata</i>				x	x						
spiked water milfoil	<i>Myriophyllum exallescens</i>										x	
spinulose woodfern	<i>Dryopteris carthusiana</i>	x										
spiny pigweed*	<i>Amaranthus spinosus*</i>											x
spiny sow thistle*	<i>Sonchus asper*</i>											x
spotted Joe-Pye-weed	<i>Eupatorium maculatum</i>		x				x		x	x		
spotted knapweed*	<i>Centaurea maculosa*</i>											x
spotted phlox	<i>Phlox maculata</i>					x		x				
spotted St. John's-wort	<i>Hypericum punctatum</i>		x	x								
spotted touch-me-not	<i>Impatiens capensis</i>	x	x				x	x	x	x		
spreading dogbane	<i>Apocynum androsaemifolium</i>	x			x							
spreading goldenrod	<i>Solidago patula</i>						x	x		x	x	
spreading star thistle*	<i>Centaurea diffusa*</i>											x
spreading witch grass	<i>Panicum dichotomiflorum</i>		x									x
spring beauty	<i>Claytonia virginica</i>	x	x			x						
spring cress	<i>Cardamine bulbosa</i>		x				x	x		x		
squirrel corn	<i>Dicentra canadensis</i>	x										
squirrel-tail grass*	<i>Hordeum jubatum*</i>			x			x					x
staghorn sumac	<i>Rhus typhina</i>	x				x						
stalked water horehound	<i>Lycopus rubellus</i>		x				x				x	
star-of-Bethlehem*	<i>Ornithogallum umbellatum*</i>	x		x		x						x
starry catchfly	<i>Silene stellata</i>	x				x						
starry false Solomon's seal	<i>Smilacina stellata</i>					x	x	x	x			
stickseed	<i>Hackelia virginiana</i>	x	x				x		x			
stiff bedstraw	<i>Galium obtusum</i>		x				x					
stiff gentian	<i>Gentiana quinquefolia</i>	x			x							
stiff sandwort	<i>Minuartia stricta</i>			x								x
stinging nettle*	<i>Urtica dioica*</i>		x									x
stink grass*	<i>Eragrostis cilianensis*</i>											x
store-front sow thistle*	<i>Sonchus oleraceus*</i>											x
stout blue-eyed grass	<i>Sisyrinchium angustifolium</i>				x							
stout wood reed	<i>Cinna arundinacea</i>		x				x				x	
straight-styled wood sedge	<i>Carex radiata</i>	x	x									
straw-colored flat sedge	<i>Cyperus strigosus</i>		x				x					x
sugar hawthorn	<i>Crataegus calpodendron</i>	x										
sugar maple	<i>Acer saccharum</i>	x	x							x		x
sugarberry	<i>Celtis laevigata</i>		x									
Sullivant's milkweed	<i>Asclepias sullivantii</i>			x								
sulphur cinquefoil*	<i>Potentilla recta*</i>				x							x
summer cypress*	<i>Kochia scoparia*</i>		x									x
summer grape	<i>Vitis aestivalis</i>	x	x		x							
sunshine rose	<i>Rosa arkansana var. suffulta</i>											x
sunshine rose	<i>Rosa suffulta</i>	x										
swamp aster	<i>Aster puniceus</i>						x	c		x		x
swamp beggars ticks	<i>Bidens discoidea</i>		x									
swamp buttercup	<i>Ranunculus septentrionalis</i>		x				x	x	x			
swamp dock	<i>Rumex verticillatus</i>		x				x				x	
swamp goldenrod	<i>Solidago uliginosa</i>						x	x	x	x		
swamp loosestrife	<i>Decodon verticillatus</i>						x	x	x			

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Flood-plain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
swamp marigold	<i>Bidens aristata</i>								x		x	x
swamp milkweed	<i>Asclepias incarnata</i>						x	x				x
swamp rose	<i>Rosa palustris</i>						x				x	
swamp saxifrage	<i>Saxifraga pensylvanica</i>						x	x	x	x		
swamp thistle	<i>Cirsium muticum</i>						x	x	x	x		
swamp tickseed	<i>Bidens cosmosa</i>										x	
swamp tickseed	<i>Bidens tripartita</i>						x				x	x
swamp white oak	<i>Quercus bicolor</i>	x										
swamp wood betony	<i>Pedicularis lanceolata</i>						x	x	x	x		
sweet autumn clematis*	<i>Clematis terniflora*</i>											x
sweet black-eyed Susan	<i>Rudbeckia subtomentosa</i>	x		x								
sweet everlasting	<i>Gnaphalium obtusifolium</i>	x		x								
sweet flag	<i>Acorus calamus</i>						x					
sweet pignut hickory	<i>Carya ovalis</i>	x										
sweet-scented bedstraw	<i>Galium triflorum</i>		x				x		x	x		
switchgrass	<i>Panicum virgatum</i>			x	x	x	x			x		x
sycamore	<i>Platanus occidentalis</i>	x	x						x			x
tall anemone	<i>Anemone virginiana</i>	x										
tall bellflower	<i>Campanula americana</i>	x	x			x				x		
tall blue lettuce	<i>Lactuca biennis</i>	x	x									
tall boneset	<i>Eupatorium altissimum</i>				x	x						x
tall coreopsis	<i>Coreopsis tripteris</i>	x		x	x							
tall fescue*	<i>Festuca elatior*</i>											x
tall forked chickweed	<i>Paronychia canadensis</i>					x						x
tall goldenrod	<i>Solidago altissima</i>	x			x		x					x
tall ground cherry	<i>Physalis subglabrata</i>		x				x					x
tall hedge mustard*	<i>Sisymbrium loesili*</i>											x
tall ironweed	<i>Vernonia gigantea</i>			x								
tall melic grass	<i>Melica nitens</i>			x	x							
tall nettle	<i>Urtica procera</i>		x									x
tall scouring rush	<i>Equisetum hyemale</i>			x								x
tall thistle	<i>Cirsium altissimum</i>	x					x					x
tall water hemp	<i>Amaranthus tuberculatus</i>		x					x				x
tall wood sorrel	<i>Oxalis stricta</i>	x	x	x		x	x					x
tansy mustard*	<i>Descurainia pinnata*</i>				x							x
Tatarian honeysuckle*	<i>Lonicera tatarica*</i>	x										x
Texas bracted sedge	<i>Carex texensis</i>	x										x
thicket creeper	<i>Parthenocissus vitacea</i>	x					x					x
thimbleweed	<i>Anemone cylindrica</i>			x	x	x						
three-awn grass	<i>Aristida longespica</i>			x								
three-seeded mercury	<i>Acalypha rhomboidea</i>		x									x
tickle grass	<i>Agrostis scabra</i>		x									
tickseed coreopsis	<i>Coreopsis lanceolata</i>				x							x
tiger lily*	<i>Lilium lancifolium*</i>											x
timothy*	<i>Phleum pratense*</i>											
toothed cress	<i>Arabis shortii</i>	x	x									
toothed spurge	<i>Euphorbia heterophylla</i>											x
toothwort	<i>Dentaria laciniata</i>	x										
Torrey's rush	<i>Juncus torreyi</i>						x					x
trailing wild bean	<i>Strophostyles helvula</i>	x		x								x
treacle mustard*	<i>Erysimum repandum*</i>											x
tree-of-heaven*	<i>Ailanthus altissima*</i>	x										x
trumpet creeper	<i>Campsis radicans</i>	x	x		x							x
trumpet honeysuckle*	<i>Lonicera sempervirens*</i>	x										x

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Floodplain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
tufted loosestrife	<i>Lysimachia thyrisflora</i>						x					
tumble mustard*	<i>Sisymbrium altissimum*</i>											x
tumbleweed	<i>Amaranthus albus</i>		x									x
Turk's cap lily	<i>Lilium michiganense</i>	x		x					x			
tussock sedge	<i>Carex stricta</i>							x	x			
twinleaf	<i>Jeffersonia diphylla</i>	x										
upland boneset	<i>Eupatorium sessilifolium</i>	x										
upright carrion flower	<i>Smilax ecirrhata</i>	x	x									
velvet leaf*	<i>Abutilon theophrasti*</i>											x
Venus' looking-glass	<i>Triodanis perfoliata</i>					x						x
violet bush clover	<i>Lespedeza violacea</i>	x										
virgin's bower	<i>Clematis virginiana</i>	x					x					x
Virginia blue bells	<i>Mertensia virginica</i>	x				x						
Virginia creeper	<i>Parthenocissus quinquefolia</i>	x	x			x						
Virginia knotweed	<i>Polygonum virginianum</i>	x										
Virginia mercury	<i>Acalypha virginica</i>	x			x							x
Virginia snakeroot	<i>Aristolochia serpentaria</i>	x										
Virginia waterleaf	<i>Hydrophyllum virginianum</i>	x	x									
Virginia wild rye	<i>Elymus virginicus</i>	x	x			x	x					x
wafer-ash	<i>Ptelea trifoliata</i>	x			x	x						x
wahoo	<i>Euonymus atropurpurea</i>	x	x						x			
water cress*	<i>Nasturium officinale*</i>						x	x	x	x	x	
water hemlock	<i>Cicuta maculata</i>			x			x					x
water horsetail	<i>Equisetum fluviatile</i>						x		x		x	
water parsnip	<i>Berula erecta</i>						x	x	x			
water parsnip	<i>Sium suave</i>						x		x	x		
water pepper	<i>Polygonum hydropiper</i>		x				x				x	
water smartweed	<i>Polygonum amphibium</i>		x				x					
water star grass	<i>Heteranthera dubia</i>										x	
water star grass	<i>Zosterella dubia</i>										x	
waterweed	<i>Elodea canadensis</i>										x	
waxweed	<i>Cuphea viscosissima</i>	x		x	x							x
waxy meadow rue	<i>Thalictrum revolutum</i>		x					x	x			
weak St. John's wort	<i>Hypericum mutilum</i>						x					x
wedge grass	<i>Sphenopholis obtusata</i>			x								
weeping willow*	<i>Salix babylonica*</i>											
western ragweed	<i>Ambrosia psilostachya</i>			x								x
western sunflower	<i>Helianthus occidentalis</i>			x	x	x						
western wheat grass*	<i>Agropyron smithii*</i>											x
wheat*	<i>Triticum aestivum*</i>											x
white ash	<i>Fraxinus americana</i>	x	x				x		x			
white avens	<i>Geum canadense</i>	x	x						x			
white campion*	<i>Lychnis alba*</i>											x
white clover*	<i>Trifolium repens*</i>											x
white forget-me-not	<i>Myosotis verna</i>	x										x
white grass	<i>Leersia virginica</i>	x	x									x
white lady's slipper (expirated)	<i>Cypripedium candidum</i>			x				x				
white mulberry*	<i>Morus alba*</i>	x	x									x
white oak	<i>Quercus alba</i>	x				x						x
white petunia*	<i>Petunia axillaris*</i>		x									x
white poplar*	<i>Populus alba*</i>			x								x
white prairie clover	<i>Dalea candida</i>			x	x							
white snakeroot	<i>Eupatorium rugosum</i>	x	x			x	x					

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Flood-plain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
white sweet clover*	<i>Melilotus alba</i> *			x								x
white trout lily	<i>Erythronium albidum</i>	x				x						
white turtlehead	<i>Chelone glabra</i>						x	x	x	x		
white vervain	<i>Verbena urticifolia</i>	x	x							x		x
white water lily	<i>Nymphaea odorata</i>										x	
white wild indigo	<i>Baptisia leucantha</i>			x	x	x						
white willow*	<i>Salix alba</i> *		x									x
white-haired panic grass	<i>Panicum villosissimum</i>	x		x	x							
whorled milkweed	<i>Asclepias quadrifolia</i>	x				x						
whorled milkweed	<i>Asclepias quadrifolia</i>	x										
whorled milkwort	<i>Polygala verticillata</i>			x	x							
wild balsam apple	<i>Echinocystis lobata</i>	x	x				x					x
wild bergamot	<i>Monarda fistulosa</i>			x	x	x						
wild chervil	<i>Chaerophyllum procumbens</i>		x				x					
wild columbine	<i>Aquilegia canadensis</i>	x				x						
wild cranesbill	<i>Geranium carolinianum</i>		x									x
wild four-o'clock*	<i>Mirabilis nyctaginea</i> *				x	x						x
wild garlic	<i>Allium canadense</i>	x	x	x								x
wild geranium	<i>Geranium maculatum</i>	x			x							
wild ginger	<i>Asarum canadense</i>	x	x									
wild hyacinth	<i>Camassia scilloides</i>			x		x						
wild hydrangea	<i>Hydrangea arborescens</i>	x	x									
wild leek	<i>Allium burdickii</i>	x										
wild lettuce	<i>Lactuca canadensis</i>	x		x								x
wild licorice	<i>Galium circaezans</i>	x		x								
wild mint	<i>Mentha arvensis</i> var. <i>villosa</i>						x	x				x
wild parsnip*	<i>Pastinaca sativa</i> *											x
wild petunia	<i>Ruellia humilis</i>			x	x	x						
wild plum	<i>Prunus americana</i>	x										
wild plum	<i>Prunus hortulana</i>	x										x
wild poinsettia	<i>Euphorbia dentata</i>		x		x	x						
wild quinine	<i>Parthenium integrifolium</i>			x								
wild rice	<i>Zizania aquatica</i>		x				x		x			
wild sarsaparilla	<i>Aralia nudicaulis</i>	x				x				x		
wild stonecrop	<i>Sedum ternatum</i>	x										
wild strawberry	<i>Fragaria virginiana</i>	x		x		x	x					x
wild sweet potato vine	<i>Ipomoea pandurata</i>		x	x								x
wild yam	<i>Dioscorea villosa</i>	x				x						
willow aster	<i>Aster praealtus</i>		x	x				x			x	
willow lettuce*	<i>Lactuca saligna</i> *											x
windmill grass*	<i>Chloris verticillata</i> *											x
winged looserstrife	<i>Lythrum alatum</i>						x	x	x			
winged pigweed	<i>Cycloloma atriplicifolium</i>			x								x
winter grape	<i>Vitis cinerea</i>	x	x		x						x	
winter vetch*	<i>Vicia villosa</i> *											x
wirestem grass	<i>Muhlenbergia mexicana</i>	x					x			x		
witch grass	<i>Panicum capillare</i>						x				x	x
witch hazel	<i>Hamamelis virginiana</i>	x	x									
wood anemone	<i>Anemone quinquefolia</i>	x										
wood blue grass*	<i>Poa nemoralis</i> *	x					x					
wood gray sedge	<i>Carex grisea</i>		x				x					
wood nettle	<i>Laportea canadensis</i>		x									
wood sheathing dropseed	<i>Sporobolus vaginiflorus</i>				x							x
wood spurge	<i>Euphorbia commutata</i>	x										

Appendix 1. Continued

Common Name ^{2,3}	Scientific Name ^{2,3}	FOREST		PRAIRIE		SAV. ⁴	WETLAND					CULT. ⁵
		Upland	Flood-plain	Prairie	Hill	Savanna	Marsh	Fen	sedge meadow	Seep	Pond/lake	Cultural
woodland blue grass	<i>Poa sylvestris</i>	x										
woodland brome	<i>Bromus nottowanus</i>	x										
woodland lettuce	<i>Lactuca floridana</i>	x	x				x					
woodland phlox	<i>Phlox divaricata</i>	x	x									x
woodland satin grass	<i>Muhlenbergia sylvatica</i>	x										
woodland sunflower	<i>Helianthus divaricatus</i>	x				x						x
wormseed mustard*	<i>Erysimum cheiranthoides</i> *								x			x
woundwort	<i>Stachys palustris</i>			x								
yellow bellwort	<i>Uvularia grandiflora</i>	x										
yellow false foxglove	<i>Aureolaria grandiflora</i>	x			x	x						
yellow flax	<i>Linum sulcatum</i>			x	x							
yellow floating heart*	<i>Nymphoides cordata</i> *										x	
yellow foxtail*	<i>Setaria glauca</i> *		x									x
yellow giant hyssop	<i>Agastache nepetoides</i>	x										
yellow hop clover*	<i>Trifolium aureum</i> *											x
yellow ironweed	<i>Verbesina alternifolia</i>	x										x
yellow monkey flower-SE	<i>Mimulus glabratus-SE</i>									x		
yellow pimpernel	<i>Taenidia integerrima</i>	x			x							
yellow pond lily	<i>Nuphar advena</i>										x	
yellow rocket*	<i>Barbarea vulgaris</i> *											x
yellow star grass	<i>Hypoxis hirsuta</i>			x	x							
yellow sweet clover*	<i>Melilotus officinalis</i> *			x								x
yellow violet	<i>Viola pubescens</i>	x										
yellow wood sorrel	<i>Oxalis dillenii</i>											x
yerba de tajo	<i>Eclipta prostrata</i>		x									

¹ This list is not intended to be complete, merely to give a representation of the vascular plant species of the IRBAA. Plants listed are documented to occur in the area, either in published literature or in the Illinois Natural History Survey's Herbarium.

² Threatened and endangered species are in bold; ST = state threatened; SE = state endangered; FE = federally endangered.

³ * = Introduced species.

⁴ SAV. = Savanna

⁵ CULT. = Cultural habitats

Appendix 2

Incomplete list of vascular plants known from the Illinois River Bluffs Assessment Area (from Appendix 1), sorted by scientific name.

Scientific Name ^{1,2}	Common Name ^{1,2}	Scientific Name ^{1,2}	Common Name ^{1,2}
<i>Abutilon theophrasti</i> *	velvet leaf*	<i>Alopecurus carolinianus</i>	common foxtail
<i>Acalypha deamii</i> -ST	large-seeded mercury-ST	<i>Amaranthus albus</i>	tumbleweed
<i>Acalypha rhomboidea</i>	three-seeded mercury	<i>Amaranthus arenicola</i> *	sandhill amaranth*
<i>Acalypha virginica</i>	Virginia mercury	<i>Amaranthus graecizans</i> *	prostrate amaranth*
<i>Acer negundo</i>	box elder	<i>Amaranthus hybridus</i>	green pigweed
<i>Acer nigrum</i>	black maple	<i>Amaranthus retroflexus</i>	rough pigweed
<i>Acer saccharinum</i>	silver maple	<i>Amaranthus rudis</i>	common water hemp
<i>Acer saccharum</i>	sugar maple	<i>Amaranthus spinosus</i> *	spiny pigweed*
<i>Achillea millefolium</i> *	common yarrow*	<i>Amaranthus tuberculatus</i>	tall water hemp
<i>Acorus calamus</i>	sweet flag	<i>Ambrosia artemisiifolia</i>	common ragweed
<i>Actaea alba</i>	doll's eyes	<i>Ambrosia psilostachya</i>	western ragweed
<i>Adiantum pedatum</i>	maidenhair fern	<i>Ambrosia trifida</i>	giant ragweed
<i>Aegilops cylindrica</i> *	jointed goat grass*	<i>Amelanchier arborea</i>	shadbush
<i>Aesculus glabra</i>	Ohio buckeye	<i>Amelanchier laevis</i>	Allegheny shadblow
<i>Agalinis aspera</i>	rough false foxglove	<i>Ammannia coccinea</i>	long-leaved ammania
<i>Agalinis gatingeri</i>	rough-stemmed false foxglove	<i>Amorpha canescens</i>	leadplant
<i>Agalinis purpurea</i>	false foxglove	<i>Amorpha fruticosa</i>	false indigo bush
<i>Agalinis tenuifolia</i>	slender false foxglove	<i>Amphicarpaea bracteata</i>	hog peanut
<i>Agastache nepetoides</i>	yellow giant hyssop	<i>Amsonia tabernaemontana</i>	blue star
<i>Agastache scrophulariaefolia</i>	purple giant hyssop	<i>Andropogon gerardii</i>	big bluestem
<i>Agrimonia pubescens</i>	soft agrimony	<i>Androsace occidentalis</i>	rock jasmine
<i>Agropyron repens</i> *	quack grass*	<i>Anemone canadensis</i>	meadow anemone
<i>Agropyron smithii</i> *	western wheat grass*	<i>Anemone cylindrica</i>	thimbleweed
<i>Agrostis alba</i> *	redtop*	<i>Anemone quinquefolia</i>	wood anemone
<i>Agrostis hyemalis</i>	hair grass	<i>Anemone virginiana</i>	tall anemone
<i>Agrostis scabra</i>	tickle grass	<i>Anemonella thalictroides</i>	rue anemone
<i>Ailanthus altissima</i> *	tree-of-heaven*	<i>Angelica atropurpurea</i>	great angelica
<i>Alcea rosea</i> *	hollyhock*	<i>Antennaria neglecta</i>	cat's foot
<i>Alisma plantago-aquatica</i>		<i>Antennaria plantaginifolia</i>	pussy toes
var. <i>americana</i>	large-flowered water plantain	<i>Anthemis cotula</i> *	dogfennel*
<i>Alisma plantago-aquatica</i>		<i>Apios americana</i>	groundnut
var. <i>parviflora</i>	small-flowered water plantain	<i>Aplectrum hyemale</i>	putty root orchid
<i>Alliaria petiolata</i> *	garlic mustard*	<i>Apocynum androsaemifolium</i>	spreading dogbane
<i>Allium burdickii</i>	wild leek	<i>Apocynum cannabinum</i>	Indian hemp
<i>Allium canadense</i>	wild garlic	<i>Apocynum sibiricum</i>	prairie Indian hemp
<i>Allium schoenoprasum</i> *	chives*	<i>Apocynum X medium</i>	hybrid dogbane
<i>Allium vineale</i> *	field garlic*	<i>Aquilegia canadensis</i>	wild columbine
		<i>Arabis canadensis</i>	sickle pod
		<i>Arabis laevigata</i>	smooth rock cress

Appendix 2. Continued

Scientific Name ^{1,2}	Common Name ^{1,2}	Scientific Name ^{1,2}	Common Name ^{1,2}
<i>Arabis shortii</i>	toothed cress	<i>Athyrium filix-femina</i>	lady fern
<i>Aralia nudicaulis</i>	wild sarsaparilla	<i>Atriplex patula</i> *	common orach*
<i>Aralia racemosa</i>	American spikenard	<i>Aureolaria flava</i>	smooth false foxglove
<i>Arctium minus</i> *	common burdock*	<i>Aureolaria grandiflora</i>	yellow false foxglove
<i>Arisaema dracontium</i>	green dragon	<i>Avena sativa</i> *	oats*
<i>Arisaema triphyllum</i>	Jack-in-the-pulpit	<i>Ballota nigra</i> *	black horehound*
<i>Aristida longespica</i>	three-awn grass	<i>Baptisia leucantha</i>	white wild indigo
<i>Aristida oligantha</i>	plains three-awn grass	<i>Baptisia leucophaea</i>	cream wild indigo
<i>Aristolochia serpentaria</i>	Virginia snakeroot	<i>Barbarea vulgaris</i> *	yellow rocket*
<i>Armoracia rusticana</i> *	horse radish*	<i>Belamcanda chinensis</i> *	blackberry lily*
<i>Artemisia campestris</i>	beach wormwood	<i>Berula erecta</i>	water parsnip
<i>Aruncus dioicus</i>	goat's-beard	<i>Betula nigra</i>	river birch
<i>Asarum canadense</i>	wild ginger	<i>Bidens aristosa</i>	swamp marigold
<i>Asclepias amplexicaulis</i>	sand milkweed	<i>Bidens bipinnata</i>	Spanish needles
<i>Asclepias incarnata</i>	swamp milkweed	<i>Bidens cernua</i>	nodding beggar ticks
<i>Asclepias purpurascens</i>	purple milkweed	<i>Bidens connata</i>	purple-stemmed tickseed
<i>Asclepias quadrifolia</i>	whorled milkweed	<i>Bidens cosmosa</i>	swamp tickseed
<i>Asclepias sullivantii</i>	Sullivant's milkweed	<i>Bidens discoidea</i>	swamp beggars ticks
<i>Asclepias syriaca</i>	common milkweed	<i>Bidens frondosa</i>	common beggar ticks
<i>Asclepias tuberosa</i>	butterfly weed	<i>Bidens tripartita</i>	swamp tickseed
<i>Asclepias verticillata</i>	horsetail milkweed	<i>Bidens vulgata</i>	common beggar ticks
<i>Asclepias viridiflora</i>	green milkweed	<i>Blephilia hirsuta</i>	pagoda plant
<i>Asimina triloba</i>	paw paw	<i>Boehmeria cylindrica</i>	false nettle
<i>Asparagus officinalis</i> *	asparagus*	<i>Boltonia asteroides</i>	false aster
<i>Asplenium platyneuron</i>	ebony spleenwort	<i>Boltonia decurrens</i>-ST	decurrent false aster-ST
<i>Aster anomalus</i>	blue aster	<i>Botrychium virginianum</i>	rattlesnake fern
<i>Aster azureus</i>	sky-blue aster	<i>Bouteloua curtipendula</i>	side-oats grama
<i>Aster cordifolius</i>	heart-leaved aster	<i>Brachyelytrum erectum</i>	black grama
<i>Aster drummondii</i>	Drummond's aster	<i>Brassica juncea</i> *	Indian mustard*
<i>Aster ericoides</i>	heath aster	<i>Brassica nigra</i> *	black mustard*
<i>Aster furcatus</i>-ST	forked aster-ST	<i>Brickellia eupatorioides</i>	false boneset
<i>Aster laevis</i>	smooth blue aster	<i>Bromus commutatus</i> *	hairy brome*
<i>Aster lateriflorus</i>	side-flowered aster	<i>Bromus inermis</i> *	smooth brome*
<i>Aster novae-angliae</i>	New England aster	<i>Bromus japonicus</i> *	Japanese chess*
<i>Aster oblongifolius</i>	aromatic aster	<i>Bromus kalmii</i>	prairie brome
<i>Aster ontariensis</i>	Ontario aster	<i>Bromus nottowayanus</i>	woodland brome
<i>Aster pilosus</i>	hairy aster	<i>Bromus purgans</i>	brome grass
<i>Aster praealtus</i>	willow aster	<i>Bromus secalinus</i> *	cheat*
<i>Aster puniceus</i>	swamp aster	<i>Bromus tectorum</i> *	downy brome*
<i>Aster sagittifolius</i>	arrow-leaved aster	<i>Buchloeë dactyloides</i>	buffalo grass
<i>Aster schreberi</i>-ST	Schreber's aster-ST	<i>Cacalia arifolifolia</i>	pale Indian plantain
<i>Aster sericeus</i>	silky aster	<i>Cacalis plantaginea</i>	prairie Indian plantain
<i>Aster shortii</i>	Short's aster	<i>Calamagrostis canadensis</i>	blue joint grass
<i>Aster simplex</i>	panicled aster	<i>Callirhoe triangulata</i>	poppy mallow
<i>Aster umbellatus</i>	flat-topped aster	<i>Caltha palustris</i>	marsh marigold
<i>Astragalus canadensis</i>	Canadian milk vetch	<i>Calystegia sepium</i>	American bindweed

Appendix 2. Continued

Scientific Name ^{1,2}	Common Name ^{1,2}	Scientific Name ^{1,2}	Common Name ^{1,2}
<i>Calystegia spithamea</i>	dwarf bindweed	<i>Carex sparganioides</i>	loose-headed bracted sedge
<i>Camassia scilloides</i>	wild hyacinth	<i>Carex stipata</i>	common fox sedge
<i>Camelina microcarpa</i> *	small-fruited false flax*	<i>Carex stricta</i>	tussock sedge
<i>Campanula americana</i>	tall bellflower	<i>Carex tenera</i>	narrow-leaved oval sedge
<i>Campanula aparinoides</i>	marsh bellflower	<i>Carex texensis</i>	Texas bracted sedge
<i>Campsis radicans</i>	trumpet creeper	<i>Carex tribuloides</i>	awl-fruited oval sedge
<i>Cannabis sativa</i> *	common hemp*	<i>Carex vulpinoidea</i>	brown fox sedge
<i>Capsella bursa-pastoris</i> *	shepherd's purse*	<i>Carpinus caroliniana</i>	blue beech
<i>Cardamine bulbosa</i>	spring cress	<i>Carya cordiformis</i>	bitternut hickory
<i>Cardamine pensylvanica</i>	bitter cress	<i>Carya glabra</i>	pignut hickory
<i>Cardaria draba</i> *	hoary cress*	<i>Carya illinoensis</i>	pecan
<i>Carduus nutans</i> *	musk thistle*	<i>Carya ovalis</i>	sweet pignut hickory
<i>Carex albolutescens</i>	long-fruited oval sedge	<i>Carya ovata</i>	shagbark hickory
<i>Carex albusina</i>	blunt-scaled wood sedge	<i>Carya tomentosa</i>	mockernut hickory
<i>Carex aritecta</i>	blunt-scaled oak sedge	<i>Cassia fasciculata</i>	partridge pea
<i>Carex bicknellii</i>	prairie sedge	<i>Castanea dentata</i>	American chestnut
<i>Carex blanda</i>	common wood sedge	<i>Castilleja coccinea</i>	Indian paintbrush
<i>Carex brevior</i>	plains oval sedge	<i>Catalpa bignonioides</i>	southern catalpa
<i>Carex bushii</i>	long-scaled green sedge	<i>Catalpa speciosa</i>	northern catalpa
<i>Carex cephaloidea</i>	rough clustered sedge	<i>Caulophyllum thalictroides</i>	blue cohosh
<i>Carex cephalophora</i>	short-headed bracted sedge	<i>Ceanothus americanus</i>	New Jersey tea
<i>Carex comosa</i>	bristly sedge	<i>Celastrus scandens</i>	bittersweet
<i>Carex conjuncta</i>	green-headed fox sedge	<i>Celtis laevigata</i>	sugarberry
<i>Carex cristatella</i>	crested oval sedge	<i>Celtis occidentalis</i>	hackberry
<i>Carex davisi</i>	awned graceful sedge	<i>Cenchrus longispinus</i>	sand bur
<i>Carex festucacea</i>	fescue oval sedge	<i>Centaurea diffusa</i> *	spreading star thistle*
<i>Carex gracilescens</i>	slender wood sedge	<i>Centaurea maculosa</i> *	spotted knapweed*
<i>Carex granularis</i>	pale sedge	<i>Cephalanthus occidentalis</i>	button bush
<i>Carex gravida</i>	long-awned bracted sedge	<i>Cerastium nutans</i>	nodding chickweed
<i>Carex grisea</i>	wood gray sedge	<i>Cerastium vulgatum</i> *	mouse-eared chickweed*
<i>Carex hirsutella</i>	hairy green sedge	<i>Ceratophyllum demersum</i>	coontail
<i>Carex hirtiflora</i>	hairy wood sedge	<i>Cercis canadensis</i>	redbud
<i>Carex hystericina</i>	porcupine sedge	<i>Chaenorrhinum minus</i> *	small snapdragon*
<i>Carex jamesii</i>	grass sedge	<i>Chaerophyllum procumbens</i>	wild chervil
<i>Carex lacustris</i>	river sedge	<i>Chamaesyce humistrata</i>	milk spurge
<i>Carex leptalea</i>	bristle-stalked sedge	<i>Chamaesyce maculata</i>	nodding spurge
<i>Carex lurida</i>	bottlebrush sedge	<i>Chamaesyce supina</i>	milk spurge
<i>Carex meadii</i>	Mead's stiff sedge	<i>Chelidonium majus</i> *	celandine*
<i>Carex molesta</i>	field oval sedge	<i>Chelone glabra</i>	white turtlehead
<i>Carex muhlenbergii</i>	sand bracted sedge	<i>Chenopodium album</i> *	lamb's quarters*
<i>Carex oligocarpa</i>	few-fruited gray sedge	<i>Chenopodium ambrosioides</i> *	Mexican tea*
<i>Carex pelliata</i>	broad-leaved woolly sedge	<i>Chenopodium berlandieri</i> *	lamb's quarters*
<i>Carex pensylvanica</i>	common oak sedge	<i>Chenopodium</i>	
<i>Carex radiata</i>	straight-styled wood sedge	<i>gigantospermum</i>	maple-leaved goosefoot
<i>Carex rosea</i>	curly-styled wood sedge	<i>Chenopodium missouriense</i>	goosefoot
<i>Carex shortiana</i>	Short's sedge	<i>Chenopodium standleyanum</i>	goosefoot

Appendix 2. Continued

Scientific Name ^{1,2}	Common Name ^{1,2}	Scientific Name ^{1,2}	Common Name ^{1,2}
<i>Chloris verticillata</i> *	windmill grass*	<i>Cuscuta compacta</i>	compact dodder
<i>Cichorium intybus</i> *	chicory*	<i>Cuscuta coryli</i>	hazel dodder
<i>Cicuta maculata</i>	water hemlock	<i>Cuscuta gronovii</i>	common dodder
<i>Cinna arundinacea</i>	stout wood reed	<i>Cuscuta pentagona</i>	prairie dodder
<i>Circaea lutetiana</i>	enchanter's nightshade	<i>Cycloloma atriplicifolium</i>	winged pigweed
<i>Cirsium altissimum</i>	tall thistle	<i>Cynanchum laeve</i>	blue vine
<i>Cirsium arvense</i> *	Canada thistle*	<i>Cynanchum nigrum</i> *	black swallow wort*
<i>Cirsium discolor</i>	pasture thistle	<i>Cynoglossum officinale</i> *	common hound's tongue*
<i>Cirsium hillii</i> -ST	Hill's thistle-ST	<i>Cyperus aristatus</i>	galingale
<i>Cirsium muticum</i>	swamp thistle	<i>Cyperus erythrorhizos</i>	red-rooted sedge
<i>Cirsium vulgare</i> *	bull thistle*	<i>Cyperus esculentus</i>	nut grass
<i>Claytonia virginica</i>	spring beauty	<i>Cyperus ferruginescens</i>	slender sand sedge
<i>Clematis pitcheri</i>	leather flower	<i>Cyperus filiculmis</i>	rusty nut sedge
<i>Clematis terniflora</i> *	sweet autumn clematis*	<i>Cyperus rivularis</i>	brook flat sedge
<i>Clematis virginiana</i>	virgin's bower	<i>Cyperus strigosus</i>	straw-colored flat sedge
<i>Comandra umbellata</i>	bastard toadflax	<i>Cypripedium calceolus</i> var. <i>pubescens</i>	larry lady's slipper
<i>Commelina communis</i> *	common day flower*	<i>Cypripedium candidum</i>	white lady's slipper (expirated)
<i>Conium maculatum</i> *	poison hemlock*	<i>Cypripedium reginae</i> -SE	showy lady's slipper-SE
<i>Convolvulus arvensis</i> *	field bindweed*	<i>Cystopteris protrusa</i>	fragile fern
<i>Conyza canadensis</i>	horseweed	<i>Dactylis glomerata</i> *	orchard grass*
<i>Conyza ramosissima</i>	dwarf fleabane	<i>Dalea candida</i>	white prairie clover
<i>Corallorrhiza odontorhiza</i>	late coral root	<i>Dalea purpurea</i>	purple prairie clover
<i>Coreopsis lanceolata</i>	tickseed coreopsis	<i>Danthonia spicata</i>	poverty oat grass
<i>Coreopsis palmata</i>	prairie coreopsis	<i>Dasistoma macrophylla</i>	mullein foxglove
<i>Coreopsis tripteris</i>	tall coreopsis	<i>Datura stramonium</i> *	Jimsonweed*
<i>Cornus alternifolia</i>	alternate-leaved dogwood	<i>Daucus carota</i> *	Queen Anne's lace*
<i>Cornus drummondii</i>	rough-leaved dogwood	<i>Decodon verticillatus</i>	swamp loosestrife
<i>Cornus florida</i>	flowering dogwood	<i>Delphinium tricornae</i>	dwarf larkspur
<i>Cornus obliqua</i>	pale dogwood	<i>Dentaria laciniata</i>	toothwort
<i>Cornus racemosa</i>	gray dogwood	<i>Descurainia pinnata</i> *	tansy mustard*
<i>Cornus stolonifera</i>	red-osier dogwood	<i>Desmanthus illinoense</i>	Illinois bundle flower
<i>Coronilla varia</i> *	crown vetch*	<i>Desmodium canadense</i>	showy tick trefoil
<i>Corydalis flavula</i>	pale corydalis	<i>Desmodium canescens</i>	hoary tick trefoil
<i>Corydalis micrantha</i>	slender corydalis	<i>Desmodium cuspidatum</i>	bracted tick trefoil
<i>Corylus americana</i>	hazelnut	<i>Desmodium glutinosum</i>	pointed tick trefoil
<i>Crataegus calpodendron</i>	sugar hawthorn	<i>Desmodium illinoense</i>	Illinois tick trefoil
<i>Crataegus coccinea</i>	scarlet hawthorn	<i>Desmodium laevigatum</i>	glaucous tick trefoil
<i>Crataegus crus-galli</i>	cockspur thorn	<i>Desmodium paniculatum</i>	panicked tick trefoil
<i>Crataegus mollis</i>	red haw	<i>Desmodium sessilifolium</i>	sessile-leaved tick trefoil
<i>Crataegus pruinosa</i>	frosted hawthorn	<i>Dianthus armeria</i> *	Deptford pink*
<i>Croton glandulosus</i>	sand croton	<i>Diarrhena americana</i>	beak grass
<i>Cryptotaenia canadensis</i>	honestwort	<i>Dicentra canadensis</i>	squirrel corn
<i>Cucurbita foetidissima</i>	Missouri gourd	<i>Dicentra cucullaria</i>	Dutchman's breeches
<i>Cuphea viscosissima</i>	waxweed	<i>Diervilla lonicera</i>	bush honeysuckle
<i>Cuscuta campestris</i>	field dodder		
<i>Cuscuta cephalanthi</i>	buttonbush dodder		

Appendix 2. Continued

Scientific Name ^{1,2}	Common Name ^{1,2}	Scientific Name ^{1,2}	Common Name ^{1,2}
<i>Digitaria ischaemum</i> *	smooth crab grass*	<i>Eragrostis pectinacea</i>	small love grass
<i>Digitaria sanguinalis</i> *	hairy crab grass*	<i>Eragrostis spectabilis</i>	purple love grass
<i>Diodia teres</i>	buttonweed	<i>Erechtites hieracifolia</i>	fireweed
<i>Dioscorea villosa</i>	wild yam	<i>Erigeron annuus</i>	annual fleabane
<i>Diospyros virginiana</i>	persimmon	<i>Erigeron philadelphicus</i>	marsh fleabane
<i>Diplazium pycnocarpon</i>	narrow-leaved spleenwort	<i>Erigeron pulchellus</i>	Robin's plantain
<i>Dipsacus laciniatus</i> *	cut-leaved teasel*	<i>Erigeron strigosus</i>	daisy fleabane
<i>Dipsacus sylvestris</i> *	common teasel*	<i>Eriochloa villosa</i> *	Chinese cup grass*
<i>Dirca palustris</i>	leatherwood	<i>Eryngium yuccifolium</i>	rattlesnake master
<i>Dodecatheon meadia</i>	shooting star	<i>Erysimum cheiranthoides</i> *	wormseed mustard*
<i>Draba reptans</i>	common whitlow grass	<i>Erysimum inconspicuum</i> *	small wormseed mustard*
<i>Dryopteris carthusiana</i>	spinulose woodfern	<i>Erysimum repandum</i> *	treacle mustard*
<i>Dryopteris x triploidea</i>	hybrid woodfern	<i>Erythronium albidum</i>	white trout lily
<i>Dyssodia papposa</i> *	foetid marigold*	<i>Euonymus atropurpurea</i>	wahoo
<i>Eragrostis poaeoides</i> *	low love grass*	<i>Eupatorium altissimum</i>	tall boneset
<i>Echinacea pallida</i>	pale purple coneflower	<i>Eupatorium fistulosum</i>	hollow Joe-Pye weed
<i>Echinacea purpurea</i>	purple coneflower	<i>Eupatorium maculatum</i>	spotted Joe-Pye-weed
<i>Echinochloa crusgalli</i>	barnyard grass	<i>Eupatorium perfoliatum</i>	common boneset
<i>Echinochloa walteri</i>	salt-marsh cockspur grass	<i>Eupatorium purpureum</i>	purple Joe-Pye-weed
<i>Echinocystis lobata</i>	wild balsam apple	<i>Eupatorium rugosum</i>	white snakeroot
<i>Eclipta prostrata</i>	yerba de tajo	<i>Eupatorium serotinum</i>	late boneset
<i>Elaeagnus angustifolia</i> *	Russian olive*	<i>Eupatorium sessilifolium</i>	upland boneset
<i>Elaeagnus umbellata</i> *	autumn olive*	<i>Euphorbia commutata</i>	wood spurge
<i>Eleocharis elliptica</i>	golded-seeded spike rush	<i>Euphorbia corollata</i>	flowering spurge
<i>Eleocharis erythropoda</i>	red-rooted spike rush	<i>Euphorbia cyparissias</i> *	cypress spurge*
<i>Eleusine indica</i> *	crowfoot grass*	<i>Euphorbia dentata</i>	wild poinsettia
<i>Ellisia nycotelea</i>	Aunt Lucy	<i>Euphorbia heterophylla</i>	toothed spurge
<i>Elodea canadensis</i>	waterweed	<i>Euphorbia marginata</i> *	snow-on-the-mountain*
<i>Elyhordeum X montanense</i>	hybrid grass	<i>Euthamia gymnospermoides</i>	grass-leaved goldenrod
<i>Elymus canadensis</i>	Canada wild rye	<i>Festuca elatior</i> *	tall fescue*
<i>Elymus hystrix</i>	bottlebrush grass	<i>Festuca obtusa</i>	nodding fescue
<i>Elymus riparius</i>	riverbank wild rye	<i>Filipendula rubra</i>-ST	Queen-of-the-prairie-ST
<i>Elymus virginicus</i>	Virginia wild rye	<i>Fimbristylis autumnalis</i>	autumn sedge
<i>Epilobium ciliatum</i>	northern willow herb	<i>Floerkea proserpinacoides</i>	false mermaid
<i>Epilobium coloratum</i>	cinnamon willow herb	<i>Fragaria virginiana</i>	wild strawberry
<i>Equisetum arvense</i>	common horsetail	<i>Fraxinus americana</i>	white ash
<i>Equisetum fluviatile</i>	water horsetail	<i>Fraxinus nigra</i>	black ash
<i>Equisetum hyemale</i>	tall scouring rush	<i>Fraxinus pennsylvanica</i>	green ash
<i>Equisetum laevigatum</i>	smooth scouring rush	<i>Fraxinus quadrangulata</i>	blue ash
<i>Equisetum palustre</i>	marsh horsetail	<i>Froelichia gracilis</i> *	small cottonweed*
	(extirpated)	<i>Galearis spectabilis</i>	showy orchis
<i>Equisetum X ferrissii</i>	intermediate scouring rush	<i>Galinsova quadriradiata</i> *	Peruvian daisy*
<i>Eragrostis capillaris</i>	lace grass	<i>Galium aparine</i>	annual bedstraw
<i>Eragrostis cilianensis</i> *	stink grass*	<i>Galium circaezans</i>	wild licorice
<i>Eragrostis hypnoides</i>	creeping love grass	<i>Galium concinnum</i>	shining bedstraw
<i>Eragrostis minor</i> *	low love grass*	<i>Galium obtusum</i>	stiff bedstraw

Appendix 2. Continued

Scientific Name ^{1,2}	Common Name ^{1,2}	Scientific Name ^{1,2}	Common Name ^{1,2}
<i>Galium pilosum</i>	hairy bedstraw	<i>Heuchera richardsonii</i>	prairie alumroot
<i>Galium triflorum</i>	sweet-scented bedstraw	<i>Hibiscus laevis</i>	halberd-leaved rose mallow
<i>Gaura biennis</i>	biennial gaura	<i>Hibiscus trionum</i> *	flower-of-an-hour*
<i>Gaura longiflora</i>	common gaura	<i>Hieracium longipilum</i>	hairy hawkweed
<i>Gentiana andrewsii</i>	closed gentian	<i>Hieracium scabrum</i>	rough hawkweed
<i>Gentiana puberulenta</i>	downy gentian	<i>Hordeum jubatum</i> *	squirrel-tail grass*
<i>Gentiana quinquefolia</i>	stiff gentian	<i>Hordeum pusillum</i> *	little barley*
<i>Geranium carolinianum</i>	wild cranesbill	<i>Humulus japonicus</i> *	Japanese hop*
<i>Geranium maculatum</i>	wild geranium	<i>Humulus lupulus</i>	American hop
<i>Geum canadense</i>	white avens	<i>Hybanthus concolor</i>	green violet
<i>Geum laciniatum</i>	rough avens	<i>Hydrangea arborescens</i>	wild hydrangea
<i>Glechoma hederacea</i> *	creeping Charlie*	<i>Hydrastis canadensis</i>	goldenseal
<i>Gleditsia triacanthos</i>	honey locust	<i>Hydrophyllum</i>	
<i>Glyceria striata</i>	fowl mann grass	<i>appendiculatum</i>	great waterleaf
<i>Glycine max</i> *	soybean*	<i>Hydrophyllum virginianum</i>	Virginia waterleaf
<i>Gnaphalium obtusifolium</i>	sweet everlasting	<i>Hypericum mutilum</i>	weak St. John's wort
<i>Gnaphalium purpureum</i>	early cudweed	<i>Hypericum perforatum</i> *	common St. John's wort*
<i>Gratiola neglecta</i>	clammy hedge hyssop	<i>Hypericum punctatum</i>	spotted St. John's-wort
<i>Grindelia squarrosa</i>	gumweed	<i>Hypericum sphaerocarpum</i>	round fruited St. John's-wort
<i>Gymnocladus dioica</i>	Kentucky coffeetree	<i>Hypoxis hirsuta</i>	yellow star grass
<i>Hackelia virginiana</i>	stickseed	<i>Impatiens capensis</i>	spotted touch-me-not
<i>Hamamelis virginiana</i>	witch hazel	<i>Impatiens pallida</i>	pale touch-me-not
<i>Hedeoma hispida</i>	rough pennyroyal	<i>Iodanthus pinnatifidus</i>	purple rocket
<i>Hedeoma pulegioides</i>	American pennyroyal	<i>Ipomoea coccinea</i> *	red morning glory*
<i>Helenium autumnale</i>	sneezeweed	<i>Ipomoea hederacea</i> *	ivy-leaved morning glory*
<i>Helianthemum bicknellii</i>	frostweed	<i>Ipomoea lacunosa</i>	small white morning glory
<i>Helianthemum canadense</i>	common rockrose	<i>Ipomoea pandurata</i>	wild sweet potato vine
<i>Helianthus annuus</i> *	garden sunflower*	<i>Iris virginicavar. shrevei</i>	blue flag
<i>Helianthus decapetalus</i>	pale sunflower	<i>Isanthus brachiatus</i>	false pennyroyal
<i>Helianthus divaricatus</i>	woodland sunflower	<i>Isopyrum biternatum</i>	false rue anenome
<i>Helianthus grosseserratus</i>	saw-toothed sunflower	<i>Jeffersonia diphylla</i>	twinleaf
<i>Helianthus hirsutus</i>	bristly sunflower	<i>Juglans cinerea</i>	butternut
<i>Helianthus microcephalus</i>	small wood sunflower	<i>Juglans nigra</i>	black walnut
<i>Helianthus mollis</i>	downy sunflower	<i>Juncus brachycephalus</i>	short-headed rush
<i>Helianthus occidentalis</i>	western sunflower	<i>Juncus interior</i>	inland rush
<i>Helianthus rigidus</i>	prairie sunflower	<i>Juncus tenuis</i>	path rush
<i>Helianthus strumosus</i>	pale-leaved sunflower	<i>Juncus torreyi</i>	Torrey's rush
<i>Helianthus tuberosus</i>	Jerusalem artichoke	<i>Juniperus virginiana</i>	red cedar
<i>Heliopsis helianthoides</i>	false sunflower	<i>Kochia scoparia</i> *	summer cypress*
<i>Hemerocallis fulva</i> *	orange day lily*	<i>Koeleria macrantha</i>	June grass
<i>Hemicarpha micrantha</i>	dwarf bulrush	<i>Krigia biflora</i>	false dandelion
<i>Hepatica nobilis var. acuta</i>	liverleaf	<i>Lactuca biennis</i>	tall blue lettuce
<i>Heracleum lanatum</i>	cow parsnip	<i>Lactuca canadensis</i>	wild lettuce
<i>Hesperis matronalis</i> *	dame's rocket*	<i>Lactuca floridana</i>	woodland lettuce
<i>Heteranthera dubia</i>	water star grass	<i>Lactuca saligna</i> *	willow lettuce*
<i>Heterotheca camporum</i>	golden aster	<i>Lactuca serriola</i> *	prickly lettuce*

Appendix 2. Continued

Scientific Name ^{1,2}	Common Name ^{1,2}	Scientific Name ^{1,2}	Common Name ^{1,2}
<i>Lamium amplexicaule</i> *	henbit*	<i>Ludwigia palustris</i>	
<i>Lamium purpureum</i> *	purple dead nettle*	var. <i>americana</i>	marsh purslane
<i>Laportea canadensis</i>	wood nettle	<i>Ludwigia peploides</i>	
<i>Lapsana communis</i> *	nipplewort*	subsp. <i>glabrescens</i>	creeping primrose willow
<i>Lechea tenuifolia</i>	slender-leaved pinweed	<i>Lychnis alba</i> *	white campion*
<i>Leersia oryzoides</i>	rice cutgrass	<i>Lycopus americanus</i>	common water horehound
<i>Leersia virginica</i>	white grass	<i>Lycopus rubellus</i>	stalked water horehound
<i>Lemna minor</i>	small duckweed	<i>Lycopus uniflorus</i>	northern bugle weed
<i>Lemma trisulca</i>	ivy-leaved duckweed	<i>Lycopus virginicus</i>	bugle weed
<i>Leonurus cardiaca</i> *	motherwort*	<i>Lysimachia ciliata</i>	fringed loosestrife
<i>Lepidium campestre</i> *	field peppergrass*	<i>Lysimachia hybrida</i>	river loosestrife
<i>Lepidium densiflorum</i> *	small peppergrass*	<i>Lysimachia lanceolata</i>	lance-leaved loosestrife
<i>Lepidium virginicum</i>	common peppergrass	<i>Lysimachia nummularia</i> *	moneywort*
<i>Leptoloma cognatum</i>	fall witch grass	<i>Lysimachia quadriflora</i>	narrow-leaved loosestrife
<i>Lespedeza capitata</i>	round-headed bush clover	<i>Lysimachia thyrsoflora</i>	tufted loosestrife
<i>Lespedeza violacea</i>	violet bush clover	<i>Lysimachia vulgaris</i> *	garden loosestrife*
<i>Lespedeza virginica</i>	slender bush clover	<i>Lythrum alatum</i>	winged loosestrife
<i>Leucanthemum vulgare</i> *	ox-eye daisy*	<i>Lythrum salicaria</i> *	purple loosestrife*
<i>Leucospora multifida</i>	obe-wan-conobea	<i>Maclura pomifera</i> *	Osage orange*
<i>Liatris aspera</i>	rough blazing star	<i>Malus ioensis</i>	Iowa crabapple
<i>Liatris cylindracea</i>	cylindrical blazing star	<i>Malva neglecta</i> *	common mallow*
<i>Liatris pycnostachya</i>	prairie blazing star	<i>Matricaria matricarioides</i> *	pineapple weed*
<i>Liatris spicata</i>	marsh blazing star	<i>Medicago lupulina</i> *	black medic*
<i>Lilium lancifolium</i> *	tiger lily*	<i>Medicago sativa</i> *	alfalfa*
<i>Lilium michiganense</i>	Turk's cap lily	<i>Melica nitens</i>	tall melic grass
<i>Lilium philadelphicum</i>	prairie lily	<i>Melilotus alba</i> *	white sweet clover*
<i>Linaria vulgaris</i> *	butter-and-eggs*	<i>Melilotus officinalis</i> *	yellow sweet clover*
<i>Lindernia dubia</i>	false pimpernel	<i>Menispermum canadense</i>	moonseed
<i>Linum sulcatum</i>	yellow flax	<i>Mentha x piperita</i> *	peppermint*
<i>Liparis liliifolia</i>	large twayblade	<i>Mentha alopecuroides</i> *	foxtail mint*
<i>Liparis loeselii</i>	lesser twayblade orchid	<i>Mentha arvensis</i> var. <i>villosa</i>	wild mint
<i>Lithospermum arvense</i> *	corn gromwell*	<i>Mentha spicata</i> *	spearmint*
<i>Lithospermum canescens</i>	hoary puccoon	<i>Mertensia virginica</i>	Virginia blue bells
<i>Lithospermum carolinense</i>	hairy puccoon	<i>Microseris cuspidata</i> - SE	prairie dandelion - SE
<i>Lithospermum incisum</i>	fringed puccoon	<i>Mimulus glabratus</i>-SE	yellow monkey flower-SE
<i>Lobelia cardinalis</i>	cardinal flower	<i>Mimulus ringens</i>	monkey flower
<i>Lobelia inflata</i>	Indian tobacco	<i>Minuartia stricta</i>	stiff sandwort
<i>Lobelia siphilitica</i>	blue lobelia	<i>Mirabilis nyctaginea</i> *	wild four-o'clock*
<i>Lobelia spicata</i>	spike lobelia	<i>Mitella diphylla</i>	mitrewort
<i>Lolium perenne</i> *	crested rye grass*	<i>Mollugo verticillata</i> *	carpet weed*
<i>Lonicera maackii</i> *	Amur honeysuckle*	<i>Monarda clinopodia</i>	basil bee balm
<i>Lonicera prolifera</i>	grape honeysuckle	<i>Monarda fistulosa</i>	wild bergamot
<i>Lonicera sempervirens</i> *	trumpet honeysuckle*	<i>Monotropa uniflora</i>	Indian pipe
<i>Lonicera tatarica</i> *	Tatarian honeysuckle*	<i>Morus alba</i> *	white mulberry*
<i>Lonicera x bella</i> *	showy fly honeysuckle*	<i>Morus rubra</i>	red mulberry
<i>Lotus corniculatus</i> *	bird's-foot trefoil*	<i>Muhlenbergia frondosa</i>	common satin grass

Appendix 2. Continued

Scientific Name ^{1,2}	Common Name ^{1,2}	Scientific Name ^{1,2}	Common Name ^{1,2}
<i>Muhlenbergia mexicana</i>	wirestem grass	<i>Parietaria pensylvanica</i>	pellitory
<i>Muhlenbergia schreberi</i>	nimblewill	<i>Parnassia glauca</i>	grass-of-Parnassus
<i>Muhlenbergia sobolifera</i>	rock stain grass	<i>Paronychia canadensis</i>	tall forked chickweed
<i>Muhlenbergia sylvatica</i>	woodland satin grass	<i>Parthenium integrifolium</i>	wild quinine
<i>Myosotis verna</i>	white forget-me-not	<i>Parthenocissus quinquefolia</i>	Virginia creeper
<i>Myriophyllum exalbenscens</i>	spiked water milfoil	<i>Parthenocissus vitacea</i>	thicket creeper
<i>Najas flexilis</i>	slender naiad	<i>Pastinaca sativa</i> *	wild parsnip*
<i>Najas guadalupensis</i>	southern naiad	<i>Pedicularis canadensis</i>	lousewort
<i>Napaea dioica</i>	glade mallow	<i>Pedicularis lanceolata</i>	swamp wood betony
<i>Nasturtium officinale</i> *	water cress*	<i>Peltandra virginica</i>	arrow arum
<i>Nelumbo lutea</i>	American lotus	<i>Penstemon digitalis</i>	foxglove beard-tongue
<i>Nepeta cataria</i> *	catnip*	<i>Penstemon pallidus</i>	pale beard-tongue
<i>Nicandra physalodes</i> *	apple-of-Peru*	<i>Penthorum sedoides</i>	ditch stoncrop
<i>Nuphar advena</i>	yellow pond lily	<i>Perilla frutescens</i> *	beefsteak plant*
<i>Nymphaea odorata</i>	white water lily	<i>Petunia axillaris</i> *	white petunia*
<i>Nymphoides cordata</i> *	yellow floating heart*	<i>Phalaris arundinacea</i> *	reed canary grass*
<i>Oenothera biennis</i>	common evening primrose	<i>Phalaris canariensis</i> *	canary grass*
<i>Oenothera laciniata</i>	ragged evening primrose	<i>Philadelphus coronarius</i> *	smooth mock orange*
<i>Oenothera rhombipetala</i>	sand primrose	<i>Phleum pratense</i> *	timothy*
<i>Onoclea sensibilis</i>	sensitive fern	<i>Phlox divaricata</i>	woodland phlox
<i>Onosmodium occidentale</i>	marbleseed	<i>Phlox glaberrima</i>	smooth phlox
<i>Opuntia humifusa</i>	eastern prickly pear	<i>Phlox maculata</i>	spotted phlox
<i>Ornithogallum umbellatum</i> *	star-of-Bethlehem*	<i>Phlox paniculata</i> *	garden phlox*
<i>Orobancha uniflora</i>	one-flowered broom rape	<i>Phlox pilosa</i>	prairie phlox
<i>Oryzopsis racemosa</i> -ST	black-seeded rice grass	<i>Phragmites australis</i>	common reed
<i>Osmorhiza claytonii</i>	hairy sweet cicely	<i>Phryma leptostachya</i>	lopseed
<i>Osmorhiza longistylis</i>	smooth sweet cicely	<i>Phyla lanceolata</i>	fog-fruit
<i>Ostrya virginiana</i>	hop hornbeam	<i>Physalis heterophylla</i>	clammy ground cherry
<i>Oxalis dillenii</i>	yellow wood sorrel	<i>Physalis subglabrata</i>	tall ground cherry
<i>Oxalis stricta</i>	tall wood sorrel	<i>Physalis virginiana</i>	lance-leaved ground cherry
<i>Oxalis violacea</i>	purple oxalis	<i>Physostegia virginiana</i>	false dragonhead
<i>Oxypolis rigidior</i>	meadow parsnip	<i>Phytolacca americana</i>	pokeweed
<i>Panax quinquefolius</i>	ginseng	<i>Pilea pumila</i>	clearweed
<i>Panicum capillare</i>	witch grass	<i>Plantago aristata</i>	bracted plantain
<i>Panicum clandestinum</i>	deer tongue grass	<i>Plantago lanceolata</i> *	English plantain*
<i>Panicum dichotomiflorum</i>	spreading witch grass	<i>Plantago major</i> *	common plantain*
<i>Panicum lanuginosum</i>		<i>Plantago rugelii</i>	red-stalked plantain
var. <i>fasciculatu</i>	old-field panic grass	<i>Plantago virginica</i>	dwarf plantain
<i>Panicum latifolium</i>	broad-leaved panic grass	<i>Platanthera hyperborea</i>	
<i>Panicum leibergii</i>	prairie panic grass	var. <i>huronensis</i>	green orchid
<i>Panicum leucothrix</i>	mat panic grass	<i>Platanthera leucophaea</i> -	prairie white fringed
<i>Panicum linearifolium</i>	slender-leaved panic grass	FE, ST, extirpated	orchid-FT, SE
<i>Panicum meridionale</i>	panic grass	<i>Platanus occidentalis</i>	sycamore
<i>Panicum oligosanthos</i>	few-flowered panic grass	<i>Poa chapmaniana</i>	spear grass
<i>Panicum villosissimum</i>	white-haired panic grass	<i>Poa compressa</i> *	Canada blue grass*
<i>Panicum virgatum</i>	switchgrass	<i>Poa nemoralis</i> *	wood blue grass*

Appendix 2. Continued

Scientific Name ^{1,2}	Common Name ^{1,2}	Scientific Name ^{1,2}	Common Name ^{1,2}
<i>Poa palustris</i>	marsh bluegrass	<i>Prunus triloba</i> *	flowering almond*
<i>Poa pratensis</i> *	Kentucky blue grass*	<i>Prunus virginiana</i>	common choke cherry
<i>Poa sylvestris</i>	woodland blue grass	<i>Psoralea onobrychis</i>	scurf pea
<i>Podophyllum peltatum</i>	mayapple	<i>Psoralea tenuifolia</i>	French grass
<i>Polanisia dodecandra</i>	clammyweed	<i>Ptelea trifoliata</i>	wafer-ash
<i>Polemonium reptans</i>	Jacob's ladder	<i>Pteridium aquilinum</i>	
<i>Polygala sanguinea</i>	field milkwort	var. <i>latiusculum</i>	bracken fern
<i>Polygala senega</i>	seneca snakeroot	<i>Pycnanthemum pilosum</i>	hairy mountain mint
<i>Polygala verticillata</i>	whorled milkwort	<i>Pycnanthemum tenuifolium</i>	slender mountain mint
<i>Polygonatum biflorum</i>	Solomon's seal	<i>Pycnanthemum virginianum</i>	common mountain mint
<i>Polygonum amphibium</i>	water smartweed	<i>Pyrus communis</i> *	pear*
<i>Polygonum aviculare</i> *	common knotweed*	<i>Quercus alba</i>	white oak
<i>Polygonum convolvulus</i> *	black bindweed*	<i>Quercus bicolor</i>	swamp white oak
<i>Polygonum cuspidatum</i> *	Japanese knotweed*	<i>Quercus imbricaria</i>	shingle oak
<i>Polygonum hydropiper</i>	water pepper	<i>Quercus macrocarpa</i>	bur oak
<i>Polygonum hydropiperoides</i>	mild water pepper	<i>Quercus muhlenbergii</i>	chinquapin oak
<i>Polygonum lapathifolium</i>	pale smartweed	<i>Quercus palustris</i>	pin oak
<i>Polygonum pensylvanicum</i>	pinkweed	<i>Quercus rubra</i>	red oak
<i>Polygonum persicaria</i> *	lady's thumb*	<i>Quercus stellata</i>	post oak
<i>Polygonum punctatum</i>	dotted smartweed	<i>Quercus velutina</i>	black oak
<i>Polygonum scandens</i>	climbing false buckwheat	<i>Quercus x runcinata</i>	hybrid oak
<i>Polygonum virginianum</i>	Virginia knotweed	<i>Ranunculus abortivus</i>	small-flowered crowfoot
<i>Polymnia canadensis</i>	leafcup	<i>Ranunculus hispidus</i>	bristly buttercup
<i>Polystichum acrostichoides</i>	Christmas fern	<i>Ranunculus pensylvanicus</i>	bristly crowfoot
<i>Polytaenia nuttallii</i>	prairie parsley	<i>Ranunculus recurvatus</i>	hooked buttercup
<i>Pontederia cordata</i>	pickerel weed	<i>Ranunculus sceleratus</i>	cursed crowfoot
<i>Populus alba</i> *	white poplar*	<i>Ranunculus septentrionalis</i>	swamp buttercup
<i>Populus deltoides</i>	cottonwood	<i>Ratibida pinnata</i>	drooping coneflower
<i>Populus grandidentata</i>	big tooth aspen	<i>Rhamnus alnifolia</i>-SE	alder buckthorn-SE
<i>Portulaca oleracea</i> *	purslane*	<i>Rhamnus cathartica</i> *	common buckthorn*
<i>Potamogeton crispus</i> *	beginner's pondweed*	<i>Rhamnus frangula</i> *	glossy buckthorn*
<i>Potamogeton foliosus</i>	leafy pondweed	<i>Rhamnus lanceolata</i>	lance-leaved buckthorn
<i>Potamogeton nodosus</i>	long-leaved pondweed	<i>Rhus aromatica</i>	aromatic sumac
<i>Potamogeton pectinatus</i>	comb pondweed	<i>Rhus glabra</i>	smooth sumac
<i>Potamogeton pusillus</i>	small pondweed	<i>Rhus typhina</i>	staghorn sumac
<i>Potentilla arguta</i>	prairie cinquefoil	<i>Ribes americanum</i>	American black currant
<i>Potentilla norvegica</i>	rough cinquefoil	<i>Ribes cynosbati</i>	buffalo currant
<i>Potentilla recta</i> *	sulphur cinquefoil*	<i>Ribes missouriense</i>	prickly gooseberry
<i>Potentilla simplex</i>	common cinquefoil	<i>Ribes odoratum</i>	Missouri gooseberry
<i>Prenanthes alba</i>	lion's foot	<i>Robinia hispida</i> *	bristly locust*
<i>Prenanthes aspera</i>	rough white lettuce	<i>Robinia pseudoacacia</i> *	black locust*
<i>Prenanthes racemosa</i>	glaucous white lettuce	<i>Rorippa islandica</i>	
<i>Prunella vulgaris</i>	self heal	var. <i>fernaldiana</i>	marsh yellow cress
<i>Prunus americana</i>	wild plum	<i>Rorippa sessiliflora</i>	sessile-flowered yellow cress
<i>Prunus hortulana</i>	wild plum	<i>Rorippa sylvestris</i> *	creeping yellow cress*
<i>Prunus serotina</i>	black cherry	<i>Rosa arkansana</i> var. <i>suffulta</i>	sunshine rose

Appendix 2. Continued

Scientific Name ^{1,2}	Common Name ^{1,2}	Scientific Name ^{1,2}	Common Name ^{1,2}
<i>Rosa blanda</i>	meadow rose	<i>Schizachyrium scoparium</i>	little blue stem
<i>Rosa carolina</i>	pasture rose	<i>Scirpus acutus</i>	hard-stemmed bulrush
<i>Rosa multiflora</i> *	multiflora rose*	<i>Scirpus atrovirens</i>	dark green bulrush
<i>Rosa palustris</i>	swamp rose	<i>Scirpus fluviatilis</i>	river bulrush
<i>Rosa setigera</i>	prairie rose	<i>Scirpus pendulus</i>	red bulrush
<i>Rosa suffulta</i>	sunshine rose	<i>Scirpus pungens</i>	chairmaker's bulrush
<i>Rubus allegheniensis</i>	common blackberry	<i>Scirpus validus</i>	great bulrush
<i>Rubus occidentalis</i>	black raspberry	<i>Scrophularia lanceolata</i>	early figwort
<i>Rubus pensylvanicus</i>	common blackberry	<i>Scrophularia marilandica</i>	late figwort
<i>Rudbeckia hirta</i>	black-eyed Susan	<i>Scutellaria galericulata</i>	marsh skullcap
<i>Rudbeckia laciniata</i>	goldenglow	<i>Scutellaria lateriflora</i>	blue skullcap
<i>Rudbeckia subtomentosa</i>	sweet black-eyed Susan	<i>Scutellaria ovata</i> var. <i>ovata</i>	heart-leaved skullcap
<i>Rudbeckia triloba</i>	brown-eyed Susan	<i>Scutellaria ovata</i> var. <i>versicolor</i>	heart-leaved skullcap
<i>Ruellia humilis</i>	wild petunia	<i>Scutellaria parvula</i> var. <i>leonardii</i>	small skullcap
<i>Ruellia strepens</i>	smooth ruellia	<i>Secale cereale</i> *	rye*
<i>Rumex acetosella</i> *	field sorrel*	<i>Sedum purpureum</i> *	liver-forever*
<i>Rumex altissimus</i>	pale dock	<i>Sedum ternatum</i>	wild stonecrop
<i>Rumex crispus</i> *	curly dock*	<i>Selaginella eclipses</i>	marsh club moss
<i>Rumex maritimus</i>	golden dock	<i>Senecio obovatus</i>	prairie ragwort
<i>Rumex orbiculatus</i>	great water dock	<i>Senecio plattensis</i>	round-leaved groundsel
<i>Rumex verticillatus</i>	swamp dock	<i>Senna hebecarpa</i>	prairie groundsel
<i>Sagittaria brevirostra</i>	short-beaked arrowleaf	<i>Senna marilandica</i>	Maryland senna
<i>Sagittaria cuneata</i>	arrow-leaved arrowleaf	<i>Setaria faberi</i> *	giant foxtail*
<i>Sagittaria latifolia</i>	common arrowleaf	<i>Setaria glauca</i> *	yellow foxtail*
<i>Salix alba</i> *	white willow*	<i>Setaria viridis</i> *	giant green foxtail
<i>Salix amygdaloides</i>	peach-leaved willow	<i>Sicyos angulatus</i>	bur cucumber
<i>Salix babylonica</i> *	weeping willow*	<i>Sida spinosa</i> *	prickly sida*
<i>Salix candida</i>	hoary willow	<i>Silene antirrhina</i>	sleepy catchfly
<i>Salix discolor</i>	pussy willow	<i>Silene cserei</i> *	glaucous campion*
<i>Salix eriocephala</i>	heart-leaved willow	<i>Silene cucubalus</i> *	bladder catchfly*
<i>Salix exigua</i>	sandbar willow	<i>Silene nivea</i>	snowy campion
<i>Salix fragilis</i> *	crack willow*	<i>Silene noctiflora</i> *	night-flowering catchfly*
<i>Salix humilis</i>	prairie willow	<i>Silene stellata</i>	starry catchfly
<i>Salix nigra</i>	black willow	<i>Silphium integrifolium</i>	rosinweed
<i>Salix petiolaris</i>	petioled willow	<i>Silphium laciniatum</i>	compass plant
<i>Sambucus canadensis</i>	elderberry	<i>Silphium perfoliatum</i>	cup plant
<i>Samolus valerandii</i>	brookweed	<i>Silphium terebinthinaceum</i>	prairie dock
<i>Sanguinaria canadensis</i>	bloodroot	<i>Sisymbrium altissimum</i> *	tumble mustard*
<i>Sanicula canadensis</i>	black snakeroot	<i>Sisymbrium loesili</i> *	tall hedge mustard*
<i>Sanicula gregaria</i>	common snakeroot	<i>Sisymbrium officinale</i> *	hedge mustard*
<i>Sanicula trifoliata</i>	beaked black snakeroot	<i>Sisyrinchium albidum</i>	common blue-eyed grass
<i>Saponaria officinalis</i> *	bouncing bet*	<i>Sisyrinchium angustifolium</i>	stout blue-eyed grass
<i>Sassafras albidum</i>	sassafras	<i>Sisyrinchium campestre</i>	prairie blue-eyed grass
<i>Saururus cernuus</i>	lizard's tail	<i>Sium suave</i>	water parsnip
<i>Saxifraga pensylvanica</i>	swamp saxifrage		

Appendix 2. Continued

Scientific Name ^{1,2}	Common Name ^{1,2}	Scientific Name ^{1,2}	Common Name ^{1,2}
<i>Smilacina racemosa</i>	false Solomon's seal	<i>Stipa spartea</i>	porcupine grass
<i>Smilacina stellata</i>	starry false Solomon's seal	<i>Strophostyles helvula</i>	trailing wild bean
<i>Smilax ecirrhata</i>	upright carrion flower	<i>Stylophorum diphyllum</i>	celandine poppy
<i>Smilax hispida</i>	bristly cat brier	<i>Symphoricarpos orbiculatus</i>	buckbrush
<i>Smilax illinoensis</i>	Illinois carrion flower	<i>Symplocarpus foetidus</i>	skunk cabbage
<i>Smilax lasioneuron</i>	common carrion flower	<i>Taenidia integerrima</i>	yellow pimpernel
<i>Smilax pulverulenta</i>	carrion flower	<i>Taraxacum laevigatum*</i>	red-seeded dandelion*
<i>Smilax rotundifolia</i>	cat brier	<i>Taraxacum officinale*</i>	dandelion*
<i>Solanum carolinense*</i>	horse-nettle*	<i>Teucrium canadense</i>	germander
<i>Solanum dulcamara*</i>	bittersweet nightshade*	<i>Thalictrum dasycarpum</i>	purple meadow rue
<i>Solanum ptycanthum</i>	black nightshade	<i>Thalictrum dioicum</i>	early meadow rue
<i>Solidago altissima</i>	tall goldenrod	<i>Thalictrum revolutum</i>	waxy meadow rue
<i>Solidago canadensis</i>	Canada goldenrod	<i>Thelypteris palustris</i>	marsh fern
<i>Solidago flexicaulis</i>	broadleaf goldenrod	<i>Thlaspi arvense*</i>	penny cress*
<i>Solidago gigantea</i>	late goldenrod	<i>Tilia americana</i>	basswood
<i>Solidago juncea</i>	early goldenrod	<i>Toxicodendron radicans</i>	poison ivy
<i>Solidago missouriensis</i>	Missouri goldenrod	<i>Toxicodendron vernix</i>	poison sumac
<i>Solidago nemoralis</i>	field goldenrod	<i>Tradescantia ohiensis</i>	Ohio spiderwort
<i>Solidago patula</i>	spreading goldenrod	<i>Tragopogon dubius*</i>	sand goat's beard*
<i>Solidago riddellii</i>	Riddell's goldenrod	<i>Tragopogon pratensis*</i>	common goat's beard*
<i>Solidago rigida</i>	rigid goldenrod	<i>Tribulus terrestris*</i>	puncture vine*
<i>Solidago speciosa</i>	showy goldenrod	<i>Tridens flavus</i>	purple-top
<i>Solidago uliginosa</i>	swamp goldenrod	<i>Trifolium aureum*</i>	yellow hop clover*
<i>Solidago ulmifolia</i>	elm-leaved goldenrod	<i>Trifolium campestre*</i>	low hop clover*
<i>Sonchus asper*</i>	spiny sow thistle*	<i>Trifolium hybridum*</i>	alsike clover*
<i>Sonchus oleraceus*</i>	store-front sow thistle*	<i>Trifolium pratense*</i>	red clover*
<i>Sonchus uliginosus*</i>	common sow thistle*	<i>Trifolium repens*</i>	white clover*
<i>Sorghastrum nutans</i>	Indian grass	<i>Trillium cernuum</i>	
<i>Sorghum halepense*</i>	Johnson grass*	var. <i>macranthum</i>	nodding trillium
<i>Sparganium eurycarpum</i>	common bur-reed	<i>Trillium flexipes</i>	declined trillium
<i>Spartina pectinata</i>	prairie cord grass	<i>Trillium nivale</i>	snow trillium
<i>Sphenopholis nitida</i>	shining wedge grass	<i>Trillium recurvatum</i>	red trillium
<i>Sphenopholis obtusata</i>	wedge grass	<i>Triodanis perfoliata</i>	Venus' looking-glass
<i>Spiraea alba</i>	meadow sweet	<i>Triosteum aurantiacum</i>	early horse gentian
<i>Spiranthes cernua</i>	nodding ladies' tresses	<i>Triosteum perfoliatum</i>	late horse gentian
<i>Spiranthes magnicamporum</i>	fragrant ladies' tresses	<i>Triticum aestivum*</i>	wheat*
<i>Spiranthes romanoffiana</i>	hooded ladies' tresses	<i>Typha angustifolia</i>	narrow-leaved cattail
<i>Spirodela polyrhiza</i>	great duckweed	<i>Typha latifolia</i>	common cattail
<i>Sporobolus cryptandrus</i>	sand dropseed	<i>Ulmus americana</i>	American elm
<i>Sporobolus heterolepis</i>	prairie dropseed	<i>Ulmus rubra</i>	slippery elm
<i>Sporobolus vaginiflorus</i>	wood sheathing dropseed	<i>Urtica dioica*</i>	stinging nettle*
<i>Sporobolus aspera</i>	rough dropseed	<i>Urtica procera</i>	tall nettle
<i>Stachys hispida</i>	marsh hedge nettle	<i>Uvularia grandiflora</i>	yellow bellwort
<i>Stachys palustris</i>	woundwort	<i>Vallisneria americana</i>	eelgrass
<i>Stachys tenuifolia</i>	smooth hedge nettle	<i>Verbascum blattaria*</i>	moth mullein*
<i>Staphylea trifolia</i>	bladdernut	<i>Verbascum thapsus*</i>	common mullein*

Appendix 2. Continued

Scientific Name ^{1,2}	Common Name ^{1,2}	Scientific Name ^{1,2}	Common Name ^{1,2}
<i>Verbena bracteata</i>	creeping vervain	<i>Vicia villosa</i> *	winter vetch*
<i>Verbena hastata</i>	blue vervain	<i>Viola pedata</i>	bird's-foot violet
<i>Verbena simplex</i>	narrow-leaved vervain	<i>Viola pedatifida</i>	prairie violet
<i>Verbena stricta</i>	hoary vervain	<i>Viola pratensis</i>	common blue violet
<i>Verbena urticifolia</i>	white vervain	<i>Viola pubescens</i>	yellow violet
<i>Verbesina alternifolia</i>	yellow ironweed	<i>Viola sororia</i>	downy-blue violet
<i>Vernonia fasciculata</i>	common ironweed	<i>Viola striata</i>	cream violet
<i>Vernonia gigantea</i>	tall ironweed	<i>Vitis aestivalis</i>	summer grape
<i>Vernonia missurica</i>	Missouri ironweed	<i>Vitis cinerea</i>	winter grape
<i>Veronica arvensis</i> *	corn speedwell*	<i>Vitis riparia</i>	riverbank grape
<i>Veronica peregrina</i>	purslane speedwell	<i>Vitis vulpina</i>	frost grape
<i>Veronicastrum virginicum</i>	Culver's root	<i>Vulpia octoflora</i>	six weeks fescue
<i>Viburnum lentago</i>	nannyberry	<i>Wisteria frutescens</i> *	Kentucky wisteria*
<i>Viburnum molle</i> - SE	soft-leaved arrowwood - SE	<i>Wolffia columbiana</i>	American water meal
<i>Viburnum opulus</i> *	European highbush cranberry*	<i>Xanthium strumarium</i> *	cocklebur*
		<i>Zanthoxylum americanum</i>	prickly ash
<i>Viburnum prunifolium</i>	black haw	<i>Zizania aquatica</i>	wild rice
<i>Viburnum rafinesquianum</i>	downy arrowwood	<i>Zizia aurea</i>	golden Alexander's
<i>Viburnum trilobum</i>	highbush cranberry	<i>Zosterella dubia</i>	water star grass

¹ Threatened or endangered species are in bold highlight: ST = state threatened, SE = state endangered;
FE = federally endangered.

² * = introduced species.

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